RAILROAD GAZETTE

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Contributions

Tree Planting on the Lake Shore in 1865.

New York, Aug. 27, 1901.

TO THE EDITOR OF THE RAILROAD GAZETTE.

Your inquiry about tree planting is received. In 1865 or 1866, while I was Chief Engineer of the Lake Shore & Michigan Southern, we planted 16,000 European larches and 20,000 chestnuts, generally alternating, a larch and then a chestnut, along the Michigan Division, setting them near the fences of the right-of-way and about 50 ft. apart. The trees were from 15 in. to 2 ft. in height and ought to have been placed in nurseries for a few years; but we thought we could exact sufficiently careful attention from the section gangs to insure their safety, in which we were mistaken. The object of the planting was to stimulate the farmers to plant, and I presume may have had a contrary effect. While the Division Superintendent who planted them remained in charge they were well cared for; I suppose not much after he left the Division. There were many survivors when I last saw them, some years ago; but from the first until then I was always disappointed in their growth, which in no respect equaled the promises of the forestry books. Our experiment was a capital example of how not to plant.

CHARLES PAINE.

To Avoid Wasting the Time of Trains.

New York, Aug. 20, 1901.

TO THE EDITOR OF THE RAILROAD GAZETTE.

An article in a recent number of the *Railroad Gazette* (July 19, p. 518) treating on Train Despatching, will meet a hearty response by all progressive men who have to deal with train service in even a slight degree.

The Burlington plan may appear revolutionary, but it is a very practical and commonsense resolution. What has been accomplished on the Burlington is capable of adoption in varying degrees on every road. But the success to be attained by the adoption of the plan is limited by conditions largely beyond the power of the Superintendent to change. Some of these I will note. 1. Too few passing sidings. 2. Sidings badly placed, making it difficult to enter or leave. 3. Telegraph offices (especially block offices) so located as to give poor outlook and difficult access to trains. 4. Motive power not "up to par," yet loaded "up to par," causing frequent failures. 5. Crossover switches in obscure places, not reached by telegraph or telephone. 6. A poor train wire, one subject to frequent interruptions (usually when most wanted). 7. Inefficient operators, not under the direct charge of the Chief Despatcher; the practice of placing telegraph operators under the direct supervision of the Superintendent of Telegraph or the Division operator reporting to the Superintendent of Telegraph, always creates friction; the telegraph department defends the operators when trouble comes, making an unsatisfactory state of affairs for despatchers to contend with. 8. Despatchers not willing to confer freely with trainmen. 9. Despatchers who are not allowed time to go over the road; they are sure to make mistakes. 10. Long despatching districts. 11. Train wire burdened with unimportant messages, reports, unnecessary train orders, requiring an assistant to each trick, work is done which should be relegated to the message wire. 12. Long Blocks; if, on the double track you can only move four or five trains in each direction in an hour you won't get extra large results under the Burlington plan.

The average double-track division of 150 miles with three eight-hour despatching tricks, with a despatcher and operator for each, could be worked to much greater advantage by cutting it into two despatching districts and making a despatcher out of the operator. Despatchers should be relieved of the mass of detail work which should be performed by a $50 clerk. Much of this work, under right plans, would take care of itself. Give the despatcher a good wire, and good line operators, who have respect for the office. Don't tie his hands. Outline your desires plainly. Talk to him just as though you were in his place. Give him a bit of encouragement after a hard day's work.

A division of 150 miles, usually requiring 12 hours in each direction for freight trains, would show a handsome improvement by a saving of one hour per train for 20 trains in each direction, or 40 in all. Forty hours' time in 24 would be equal to practically increasing the engine trips to 10 round trips in a month, to say nothing of cutting down over-time and burning less fuel by 1,200 hours. The economy of the Burlington plan must appeal strongly to any one who will stop to consider it.

X.

The Handling of Freight Traffic.*

BY L. C. FRITCH, *Supt. B. & O. S-W. R. R.*

The revenue derived from the freight traffic of the railroads of the United States represents, approximately, three-fourths of the entire revenue from operation, the figures for the year ending June 30, 1900, being $913,700,000, creditable to freight revenue alone. The transportation of freight may be held to be the most important branch of the railroad service.

An apology is offered the Association for the selection of this subject by the writer, on the ground that a subject of such vast importance should have been given more time and thought than has been possible to bestow upon it during the short time that has elapsed since the subject was assigned, and that the subject matter is herein given only superficial treatment, but it is hoped that this paper will be but a prelude to what more experienced and capable students of railway operation may speedily supply, which, if done, will, in a measure, atone for the incompleteness of the present paper.

The railroad mileage in the United States in 1876 was 76,000 miles; in 1900, 195,000 miles, an increase of 157 per cent. The gross earnings from operation in 1876 were $503,000,000; in 1900, $1,336,000,000, an increase of 166 per cent. The net earnings from operation in 1876 were $185,000,000; in 1900, $447,000,000, an increase of 141 per cent. Tons of freight moved in 1876, 197,082,000; in 1900, 975,790,000, an increase of 400 per cent. . . . Population of the United States in 1876, 45,137,000; in 1900, 76,304,000, an increase of 70 per cent.

While gross earnings have increased 166 per cent., yet the tons of freight handled have increased 400 per cent. With only an increase of 166 per cent. in number of locomotives, an increase of 400 per cent. in tons of freight were handled, which indicates that the locomotive of 1900 is performing nearly three times the service of the locomotive of 25 years ago. Also in the matter of car equipment, 246 per cent. increase in equipment is handling 400 per cent. increase in tonnage. . . .

The mines of the country furnish about one-half the tonnage; manufactures come second with about one-eighth; agriculture occupies third place, furnishing about one-ninth; forests fourth place with a little less than one-ninth; and it is remarkable to note that merchandise contributes only about one-twentieth.

The freight service is properly divisible into three classes: 1. Fast freight service; 2. Common through freight service; 3. Local freight service.

The fast freight service usually embraces the handling of such commodities as live stock, perishable freight, merchandise and other high-class freight, taking the higher rates, and should be designated by the proper officials of the traffic and transportation departments. Only about 10 per cent. of the entire freight traffic is included in the commodities known as live stock, perishable and merchandise; a large percentage of the tonnage, however, of high-class freight taking higher rates if moved on fast-freight schedules, the exact percentage being difficult to ascertain, but an estimate of 20 per cent. for the entire country will not be far from correct, which would make the average for the whole country 30 per cent. of the total freight traffic, which is handled in fast-freight service. . . .

The cost of transporting fast freight, by reason of high speed and consequently limited train load, is largely in excess of the cost of handling slow-freight commodities. . . . We are indebted to E. H. McHenry, Chief Engineer Northern Pacific Railway, for carefully prepared figures on the cost of moving trains at various speeds. His figures show that on the Minnesota Division, westbound, at a speed of 15 miles per hour, an engine developing 400 h.p. and hauling 1,050 gross tons, the cost per train mile was 60 cents; at a speed of 20 miles per hour the tonnage is reduced to 949 tons, and the cost of equivalent train mile increases to 68.6 cents; at 25 miles per hour we find the tonnage reduced to 631 tons, and the equivalent train mile cost $1.067; at 30 miles per hour, tonnage 431, equivalent train mile cost, $1.745; at 35 miles per hour, tonnage 304, equivalent train mile cost, $2.743, the result being that at a speed of 35 miles per hour it costs 4½ times as much to move an equivalent tonnage as at the speed of 15 miles per hour over the particular division of road in question. . . . There are other elements of cost which are not included in the above figures, such as additional track maintenance, loss of time to slow freights clearing the line for high-speed trains, etc.

To successfully handle fast-freight service certain fundamental principles must be observed:

First—The schedule must be such as can be maintained to insure prompt and regular service.

Second—The tonnage should be restricted to the limit of the capacity of the engine to maintain the average schedule on the maximum gradients, and a proper train limit should be imposed to make due allowance for the increased friction on account of length of train.

Third—The consist of fast freight trains should be restricted to the commodities entitled to such service, and no other commodities handled in such trains except on special authority from the proper officer.

Fourth—The system of carding cars and manifest cards for the movement of same to be of a distinctive and attractive character, to be readily distinguished, and the insistence upon such carding and card billing being properly respected by all.

Fifth—The prohibition of placing cars containing fast freight cards or billed under fast freight service on common or slow freight trains without an order from the proper officer.

Sixth—The handling of fast freight to and from connecting lines to be made the matter of special instruction by a carefully planned system of interchange of information between the lines as to the time of arrival of such freight at the junction point, the number of cars, contents, origin and destination of same, and full information in regard to icing and ventilating, and in the case of stock shipments, time when loaded, and last fed and watered, each line also agreeing to make such freight the matter of quick switching movements.

Seventh—No local service should be performed by fast freight trains, excepting the interchange of such freight with connections at junction points and the picking up and setting off at terminals. All such work should be carefully planned in advance, and where possible, as much of the work done for the fast freight trains by slow or local freight trains as possible, in order to minimize the delay to the fast freight service.

Eighth—The changing of engines and crews at terminals to be made with the minimum delay, the advance notice of time of arrival of such trains to be given yardmen, to enable them to make all preparations for quick handling.

Ninth—The fast freight schedule should be superior to that of all other classes of freight trains, in order to give them the right of track over such trains, minimizing delays at meetings and passing points.

Tenth—In case a car of fast freight is made bad order en route, and setting out short of destination becomes a matter of last resort, the conductor of such train shall be required to wire proper authority, giving car number, full billing reference, contents, and nature of defect. It should then be followed up immediately, car repairers notified, sent to such point on first train, repairs made and car forwarded on first possible schedule. If possible, car should not be set out for defect, but taken to first terminal, fully reported in advance, and repairs made and car forwarded on same schedule, permission having been received from proper authority to delay train for such car if necessary and practicable.

Eleventh—Proper instructions should be issued to agents at local points to load fast freight in time to be handled by local freight trains to the first terminal, to be there added to fast freight trains.

Twelfth—The re-icing of cars in fast freight trains should be handled in an especially careful and systematic manner. On important and long through runs it is indispensable that at frequent intervals icing stations be provided at which icing may be quickly and conveniently effected. Icing stations are preferably located at terminals, where the work may be done while engines and crews are being relayed, inspections of trains made and cars set off and picked up.

Car cards should plainly mark the cars, showing character of contents. Way-bills should plainly indicate where such cars should be re-iced, and agents at terminals should be required to give advance notice to next icing station, giving full information in regard to cars requiring re-icing, in order that all preparation shall have been made upon the arrival of such train, in order that the delay in icing may be minimized.

In the handling of perishable freight, the greatest care should be exercised to prevent damage. The temperature at which perishable goods are liable to damage varies greatly with the different commodities, their condition when loaded, length of time in transit, whether subject to long delays in transit, etc. In ordinary freight cars it has been found that perishable freight can be shipped safely when the temperature of the outside atmosphere is at plus 20 degrees F., and in refrigerator cars when it is at plus 10 degrees F.

In refrigerator cars, perishable goods can be safely transported when the outside temperature is—10 degrees F., provided the car is properly heated when loaded, and at the end of the journey the contents are not long exposed to a low temperature. The better refrigerator cars have been tested to handle safely perishable goods when the outside temperature is—20 degrees F., and the length of time in transit does not exceed two or three days. In ordinary refrigerator cars, however, a temperature of zero, F., is considered dangerous for extremely perishable commodities. During seasons of low temperature only the best refrigerators should be used in the transportation of perishable freight. During seasons of high temperature fresh beef should be chilled to a temperature of plus 36 degrees F., and the cars should be

*From a paper published in the August *Proceedings* of the St. Louis Railway Club.

brought to the same temperature when loaded, and maintained at a uniform temperature while in transit.

The Symbol Method.—The operation of fast freight by the symbol system furnishes a convenient system of handling important freight trains by designating such trains as symbol trains.

A symbol is a combination of letters and numbers so arranged as to indicate in a general manner the origin and destination of a train, and is designed to preserve its identity from numerous other trains of various classes. It is practically serviceable on lines of heavy traffic, it thereby being possible to quickly distinguish between the trains of greater and lesser importance.

The first letter of the symbol indicates the origin or starting point where most of the freight is taken on. The second letter indicates the destination or points to which the train runs. Odd numbers in the symbol indicate westbound or northbound, and even numbers eastbound or southbound trains.

Thus, as a practical illustration, and applied to the Pennsylvania railroad, if the letter J. represents Jersey City, and P. Pittsburgh, J. P. 1 would indicate a westbound symbol train originating at Jersey City and destined to Pittsburgh, carrying important fast freight. The lower the numeral, the higher the class of freight on such train. Likewise, P. J. 2 would indicate an eastbound symbol train originating at Pittsburgh and destined to Jersey City.

Particular instructions are issued to yardmasters with reference to the handling of symbol trains, and conductors are required to know which particular symbol train is to be run by them before going out on such run. No freight is picked up at intermediate points by symbol trains, but if important freight is to be moved on such trains from intermediate points, it must be moved ahead to the designated pick-up point in advance of the schedule of such symbol train. The tonnage of the symbol train is limited to the ability of the power to maintain the schedule of the symbol train. If the tonnage of important freight is less than the allowed maximum, less important freight may be used to fill up, but must be set off if fast freight is to be picked up at the next pick-up point.

Symbol trains are not annulled short of destination except when falling behind on their schedule and on the schedule of a following symbol train. When the volume of business requires, sections of symbol trains may be run, designating such sections as 2nd J. P. 1, or 3rd J. P. 2, as the case may be. The schedule published of symbol trains does not confer any time-table or running rights. The working schedule or symbol book should show exactly what freight is to be picked up or set off at such points as are served by symbol trains, and no deviation made therefrom except upon the authority of the Superintendent.

Where a symbol train extends over several divisions, each division must give advance notice to the succeeding division of the time of arrival of such symbol train, on what schedule it is running, and a consist of the train, to expedite its movement.

On some lines the use of designating trains by symbol is extended to the handling of ordinary freight other than fast freight, and over local freights, called division symbol trains.

The schedule of fast-freight service should be of a class superior to all other freight trains, and should be scheduled in each direction. The number of schedules required will vary with the volume of business, beginning with two schedules, 12 hours apart, and ranging up to three schedules, eight hours apart, to four schedules, at six hours' intervals, as the volume of business may demand. It is considered better practice to have a sufficient number of schedules to handle the minimum volume of business, and when traffic increases, running sections of such schedules, than to create schedules that cannot be filled, requiring annulment of such schedules.

Common Through Freight Service.—The term common through freight applies to other than fast freight whose origin and destination lies beyond the limits of a single local freight district. It is safe to assume that nearly 50 per cent. of the entire freight tonnage is embraced in the classification of common through freight. The element contributing most directly to economy in handling freight traffic is the maximum train load. . . . The maximum train load is a quantity, the definition of which has not yet been attempted. . . . The economical maximum rating . . . is one of the problems of transportation which should be speedily solved, as it is one of the most vital questions confronting the operating official to-day. The first step necessary to obtain a maximum train load is to establish a system of rating of all locomotives over every part of the line. . . . Having determined the rating of locomotives, the next step is to insist upon its strict observance, requiring an account to be given in each instance for a failure to at all times handle the given maximum rating. . . .

An element largely contributing to a high train load is the full lading of cars, utilizing them to their maximum capacity. It has the effect of consolidating the tonnage into the minimum number of cars, reducing the dead load and resulting resistance due to increased train length.

Another principle which, if observed, will increase the train load, is to require that through freights shall handle only through business, and requiring that local freight trains shall handle all business on their respective districts. . . . One of the sources of delay to common through freight traffic is met with on lines having varying grades, and, consequently, various tonnage ratings, where a custom of setting off and picking up, or the turning of a number of trains for following trains to pick up, is in use, and at which points the business is not of a sufficient volume to warrant maintaining helper service. It is not unfrequent that at such points a delay of from 12 to 24 hours is encountered, rendering the aggregate delay over a system a serious question in the prompt handling of traffic.

At such points a rigid system of checking should be established, requiring reports to be made every 12 hours of loads on hand, giving time such business has been detained, also requiring that the oldest loads be always moved forward first. It is often necessary to run trains through light of tonnage to avoid excessive delays to freight already held over the period usually allotted at such points.

Common through freight is preferably handled on schedules inferior to fast freight schedules, being scheduled in one direction only, having a sufficient number of such schedules, with intervals, to meet the requirements of the volume of traffic, moving at normal times, and in sections, of such schedules in times of heavy volume of business. In the reverse direction, such traffic is preferably handled on extra trains, which are moved as promptly as trains are made ready. The schedules provided in the ruling direction should not be so numerous as to require annulment on account of lack of business. . . .

General Questions.—The proper classification of freight traffic under a system such as outlined in the foregoing or modified to meet the requirements of the individual line is essential to the expeditious and economical handling of the traffic.

The matter of disposition of various commodities in relative position in the train is one on which there is a divergence of opinion. The preponderance of practice favors the placing of stock at the head end of the train, expediting the quick delivery of such traffic on arrival at the terminal; also reducing the shock to cars when handled at the rear end of trains; oil, spirits and explosives are preferably handled in the middle of train, always having at least five cars of other freight ahead and behind such freight to obviate danger of fire in case of butting or rear end collision; empty flat cars are handled almost universally just ahead of the caboose to minimize danger of breaking such cars in two in sudden stops; loads are preferably handled at head end of train, and empty cars at rear, the theory being that on momentum grades there is less liability to cause doubling, as the heaviest part of train is sooner over the summit of grade, if loads are all ahead, which is borne out in practice, but the claim that a train will pull easier with loads ahead and empties in rear is not borne out by actual tests with dynamometer car, the draw-bar pull registering the same in each case.

The car doors on all empty box cars should be kept closed in transit, for the reason that the resistance from wind pressure is reduced, the invitation to tramps to board cars is not so open, and the danger of sparks from engine of train or from passing engines lodging in cars, causing fire, is reduced. Trains should invariably be made up in station or junction order, with due regard to air and non-air cars and commodity, to reduce delay in switching at junctions and terminals.

Handling L. C. L. Merchandise Freight at Large Commercial Centers.—The handling of less carload shipments of merchandise freight at large commercial centers forms in itself an important part of the transportation problem.

The facilities for such handling are usually embraced in an outbound and an inbound house, or series of such houses, to meet the requirements of volume of business handled.

Where the volume of business handled justifies, it is a good principle to have separate houses for inbound and outbound freight.

An outbound house, if constructed separately, should preferably be narrow, not exceeding 24 to 30 ft. in width, to limit the trucking from point of delivery by team or transfer into the car.

To increase the number of cars, placeable at an outbound house, a series of parallel track, spaced, centers to centers, sufficiently to permit of an island platform 7 to 8 ft. in width being constructed between each pair of tracks, forms an ideal arrangement, it being possible by this means of accommodating as many lines of cars at the outbound house for loading at one time as there are individual tracks, trucking into any cars in the arrangement being easily effected by the means of the island platforms. This principle is recommended over the practice of having tracks close together, without island platforms between, necessitating the spotting of cars with doors opposite each other. The objections against the latter arrangement are, trucking must be done in direct lines through cars, in which case truckers naturally interfere with each other in passing each other, as, for example, an empty truck on its return trip must meet a loaded truck going into car, creating a delay to one or the other. Again, the cars must be placed with doors exactly opposite, causing a large amount of switching in the placement of cars for loading, and again a recoupling when forwarding at end of loading period.

Scales should be provided at frequent intervals, not greater than 50 to 100 ft. apart, arranged on the side of the house where delivery of freight is made. The beams of scales should be parallel with and against wall of building, leaving no obstruction in the way of trucking.

Conspicuous signs should be placed at openings on delivery side of house, indicating the points for which freight is received at such openings. All openings should be numbered with a series number, indicating particular location. The cars for the various points of loading should be placarded, and should be placed on the particular track opposite the point at which freight for such point is received. If a series of tracks is used with island platforms between the cars on track, one may be prefixed with the figure 1, those on track two by the figure 2, with a hyphen between, followed by the order number of the car on track, counting from one end of house. Thus, 1-10 indicates car 10 on track No. 1, and is for New York loading. A painted signboard 1-10 is hung on this car, and all trucks containing freight for this car are marked in crayon 1-10. The trucker is required to go into car 1-10 and take from a hook hung inside the car one of the checks marked 1-10 and return with it to the checker who loaded his truck. He hands this to the checker, it is marked off, and thus an absolute check is secured, that the freight has been loaded into the proper car.

The inbound house is preferably a wider house than the outbound, on account of the necessity of unloading from cars into house and holding for delivery. . . . The same principles pertain to the inbound as to the outbound house in the matter of having a series of parallel tracks with island platform between, increasing the car capacity at the house to be unloaded at one time and at one setting. . . .

All over, short and damage reports should be compiled from day to day, and at end of each week a report sent to freight claim department from each station. This report should be complied each week by the freight claim department, and a copy sent to each station for check and comparison, to locate the over and short freight. It will be found by this system that much tracing is saved, also much needless delay and correspondence obviated by the claim department. . . .

The practice of storing freight in freight houses should be regulated, and certain restrictions or limitations placed on the time such freight may be stored, at the end of which time it should be sent to a licensed warehouse for storage. The average railway company is not equipped to store an unlimited amount of freight in freight houses, and when even moderate amounts are so stored the cost of handling the freight by reason of the congested condition of house is largely increased. The handling of carload freight through freight houses should also be restricted, the legitimate and proper use of freight houses and freight platform being the handling of less than carload freight, to which use it should be restricted by proper and reasonable regulations. . . .

A Study of the Life of Cross Ties.

BY P. H. DUDLEY, C. E., PH. D.

The notes which follow deal principally with the record of 12 years' service of untreated yellow pine cross ties under the traffic of the New York Central & Hudson River Railroad. This is nearly the full limit of time it takes for the fungus Lentinus lepideus Fr. to decay the yellow pine untreated cross ties, so as to be unserviceable on the Eastern Division, New York to Albany, of the New York Central & Hudson River Railroad. On the Middle Division, Albany to Syracuse, and the Western Division, Syracuse to Buffalo, the climatic conditions are not quite so favorable for the rapid growth of the fungus and a slight increase in the life of the wood should obtain, except as modified by the ballast. In the Southern States the time for the growth of this fungus to decay the wood of the cross ties of yellow pine is reduced to six years, or even less, in some places. On the Isthmus of Panama, where the conditions for the growth of the fungi are more favorable and continuous for the entire year, the time would be reduced to two years or less.

As the stiffer rails replaced the lighter 4½-in. sections of a few years since, the service of the yellow pine cross ties has been increasing from eight to nine years to an average of 11.5 years for the present under a heavier traffic of greater volume and intensity. The yellow pine cross ties under the stiff rails no longer cut under the rail seats as formerly, nor are they injured by as frequent tamping as was required under the light rails.

The yellow pine cross ties, illustrated by Figs. 1 to 6, were in service 12 years in the northbound track near Ludlow Station, Eastern Division of the New York Central & Hudson River Railroad, an increase in service as formerly obtained of 20 to 25 per cent. under the 4½-in. 65-lb. rails. The cross ties were taken out June 7, 1901, and sent to Yonkers and photographed the following day, to show their conditions as they came out of the ballast. Had the wood been allowed to dry before photographing the sides and bottoms converted into "humus" by the fungus would have checked both transversely and longitudinally, showing the injury to the wood to be more extensive than now appears to be the case. These cross ties are to be used for growing the fungi which have induced their decay and drying the wood was not permissible. When they were removed from the track the fungus Lentinus lepideus Fr. was not in fruit, but since then I have secured specimens from adjacent yellow pine cross ties. They were selected by the section foreman as representative cross ties needing renewal. The ballast was broken granite and well drained. The track on the Eastern Division is from 8 to 12 ft. above high tide in

the Hudson River and opposite where they were in service the water is brackish.

From the standpoint of the limited abrasion under the rail seats the cross ties form a remarkable exhibit. It is small for the heavy traffic and the 12 years' service. For the past few years the tonnage has been approximately a million tons per month, the passenger locomotive driving wheel axles carrying from 44,000 to 48,000 lbs. as static loads. The speeds of the through trains at this location often exceed 60 miles per hour. The expenditure is from 800 to 1,100 h.p., which increases the static loads by dynamic effects of large amounts. The cross ties supported the pioneer 5-in. 80-lb. rails, moment of inertia 26.0-4 power in., 4¾-in. base, for 5 years, carrying approximately 104,000 passenger trains and 15,000 freight trains and only abraded from ⅛ to $^{3}/_{16}$ in. in depth under the rail seats. In May, 1894, the cross ties were adzed to lay the 6-in. 100-lb. rail, moment of inertia 48.5-4 power in., 5½-in. base. The 100-lb. rail figures 86.5 per cent. stiffer than the 5-in. 80-lb. section. The yellow pine cross ties remained under the 100-lb. rails 7 years, carrying approximately 151,500 passenger trains and 21,000 freight trains, or a total of 291,500 trains for both rails. Freight trains only use this track a portion of the night and their number therefore is not large, though forming a large proportion of the total tonnage.

The approximate tonnage carried by the cross ties was as follows:

80 Lb. Rails.

	Tons.
Passenger trains	35,400,000
Freight trains	15,000,000
	50,400,000

100 Lb. Rails.

Passenger trains	64,400,000
Freight trains	25,200,000
	89,600,000
Total	140,000,000

Under the 100-lb. rail seats the wood only abraded $^{1}/_{16}$ to ⅛ of an inch in depth, as can be noticed by the illustrations. Only the joint ties for the three-tie joints had tie plates. In England and on the Continent, where the cross ties are creosoted I was not able to find better specimens of the limited abrasion of the wood. I did not find examples of as heavy traffic, though the service was longer in years.

At the Paris Exposition of 1900, at Vincennes, the State Railroad of France exhibited several cross ties of oak and beech which were creosoted and had rendered many years of service. Engravings of these are not reproduced.

No. 4 oak, 1874, was marked as having sustained the passage of 250,000 trains. Bull-headed rails in chairs were used on the cross ties and the chair seats were worn down ⅛ in. and the holes of the screw spikes were also worn. The brittleness of the wood fibers had increased from the long service, though still appearing sound.

No. 5 beech, 1870, marked as having sustained the passage of 300,000 trains, the chair seats were worn as in No. 4.

No. 6 oak, 1869, and No. 7 beech, 1869, did not state the number of trains. There was abrasion but not mechanical disintegration of the wood fibers, except in the holes for the screw spikes, and that limited to simple enlargement after the long service.

The London & North Western Railway Co., of England, place a hair felt ¼ in. thick between their cast-iron chairs and the creosoted cross ties of Baltic pine. The hair felt wastes away and some abrasion of the wood occurs under the chair seats. The rails, chairs and cross ties after 10 or 12 years in the main line are taken up and placed in subsidiary lines where they do six to eight years further service.

The English cross ties eventually fail by the slow decay of the central portion of the timber which was not impregnated by the creosote preparation. For a wood which is so light and non-resistant to decay when untreated, they obtain a remarkable service from the cross ties. The form of the transverse section of the cross tie, 5 x 10 in., two being cut out from each log, and by treating, utilizing more than one-half of the sap wood, but little timber is wasted from the tree. See Fig. 7.

It is a study in the economical use of the timber, and the time for its growth in the forest, which we have not been obliged to consider so carefully with our once virgin forests, though now nearly denuded.

The Belgian Government, in their oak and beech cross ties, which they grow, utilize all of the sap wood by creosoting the half-round timber from which only the bark has been removed. See Fig. 8. In the track the stone ballast practically covers the cross ties. Heavy tie plates are used upon each cross tie which is notched to thickness for its seat and then the rail is held by heavy screw spikes. The tangential section of the wood forms the tie plate seat in all cases. In the English ties the tangential section of the wood, also including part of the sap wood, is selected always for the chair seat, thus using the wood to the best advantage.

Fig. No. 1 shows the traces of the spike holes for the 5-in. 80-lb. rails, also the 6-in. 100-lb. rails. Respiking for either section of the rails not having been required.

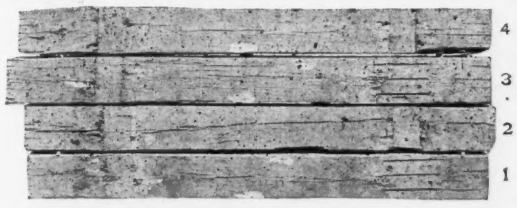


Fig. 1.

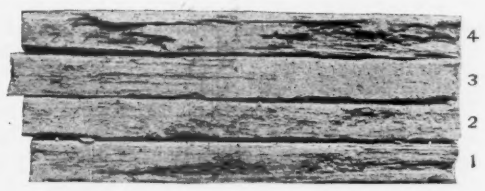


Fig. 3.

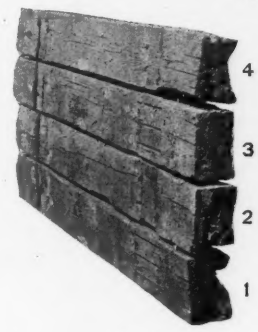


Fig. 2.

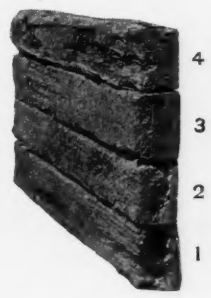


Fig. 4.

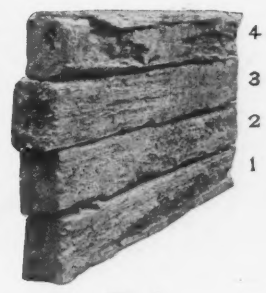


Fig. 5.

Fig. 6.

A Study of the Life of Ties—New York Central & Hudson River R. R.

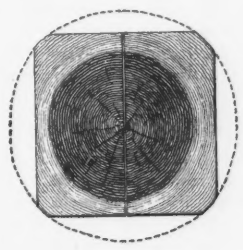


Fig. 7.—Baltic Pine.

Fig. 8.—Belgian Oak.

Under the 4½-in. 65-lb. rails the cross ties were injured by the frequent respiking. The cross ties shown in Fig. 1, by Nos. 1, 2 and 4 were heart wood, the center of growth being nearly central in the cross tie, while No. 3 was from a larger tree, the center not being included. No. 4 is from a smaller tree and was "shaky," incident to injuries received by the tree during growth. It is not as resistant to the growth of the fungus Lentinus lepideus Fr. as the other timbers, as seen from the under side of the cross ties in Fig. 3, the decay of the injured wood by the spikes being more advanced. The heart wood of yellow pine contains so little tannin that there is not as decided a discoloration of the wood in the vicinity of the spikes as in oak or chestnut, though the shattered and broken layers of wood are separated and darkened.

In Fig. 3 the ends of the cross ties, Nos. 1, 2 and 4 on the right hand, and of No. 4 on the left hand, are the ends under the outer or shoulder rail. In the location from which these cross ties were taken from the track the outer ends received less sunshine and retained more moisture than the opposite ends and the fungus has grown more rapidly under the shoulder than the inside rail. The ends of the cross ties under the shoulder rails require more tamping than the opposite ends and in many cases the decay is more rapid as well. The opposite ends are shown in Figs. 2 and 5.

In Fig. 3 the undersides do not show abrasion on the separate blocks of the stone ballast, as was formerly the case under the 4½-in. 65-lb. rails. In many cross ties removed from the track the separate fragments of the stone ballast would wear and imbed themselves ¼ in. or more in the wood, while the rail seat cut into the top ½ in. or more in three or four years, and adzing would be required. The rail seat area of the 4½-in. rails was 38.25 sq. in., for the 80-lb. rails 42.75 sq. in., and for the 100-lb. rails 49.5 sq. in. The increased areas of the rail seats are not of themselves sufficient to account for the lessened abrasion of the stiffer sections compared with the lighter rails, the increased stiffness of the heavy rail sections being the most important element.

The distribution of the strains and the resisting stresses set up in the stiff rails under moving trains is so much more favorable than it can possibly be in light rails that the wood of the cross ties is not so quickly injured under the rail seats. The fact of the limited abrasion under the cross ties after so long service as shown in the illustrations is proof from actual service that stiff rails equalize and distribute the moving wheel loads under the wheel base of the locomotives or car trucks more uniformly and with less intensity per tie than is possible for the light rails. I have walked over many miles of the track and the limited abrasion is representative of the oldest cross ties under the 100-lb. rails, and is not more than would have occurred on treated wood for the heavy service.

The area of the rail seat of the 100-lb. rails is less than one-half of the area of the chairs for the bull-headed rails in England or France. The limited abrasion which now occurs under the stiff rails, particularly the 6-in. 100-lb. section, is of secondary importance and does not reduce the efficient service or life of the yellow pine cross ties, even for the present heavy service and wheel loads of the New York Central & Hudson River Railroad. There were 18 cross ties per 30-ft. rail under the 100-lb.; the same as under the 80-lb. rails. The cross ties were 8 ft. long and 6 x 9 in., each containing 3 cu. ft. of wood, and average about 155 lbs., though there is a wide range in the weights per individual cross tie per cubic foot.

In the decayed cross ties there is also as great a range in the weight. From the moisture absorbed the wood as it decays may increase slightly in weight so long as it remains in the ballast. Below will be found the weights of cross ties removed from the track. The weights of the decayed yellow pine cross ties represented in the illustrations were as follows:

Stone Ballast.

No.	Dimensions.	Cubic feet.	—Weight, lbs.— Per cross tie.	Per cu. ft.
1..	6 in. x 9 in. x 7 ft. 11 in.	2.96	160	54
2..	6 in. x 8¾ in. x 8 ft. 1 in.	2.93	140	48
3..	6 in. x 9 in. x 8 ft. 4 in.	3.12	145	46
4..	6 in. x 8¾ in. x 8 ft. 1 in.	2.93	150	51
			148.75	49.75

These cross ties are from subdivision No. 3, W. H. Van Wie, Supervisor.

As an observation from a number of comparative weights, decayed yellow pine cross ties in well drained granite ballast are as a rule lighter than those from gravel ballast, on the New York Central & Hudson River Railroad. The well-drained stone ballast is one of the important means at the command of the engineer to increase the life of untreated yellow pine cross ties.

TABLE NO. 1.—WEIGHT OF DECAYED YELLOW PINE CROSS TIES IN FAIR CONDITION.

Gravel Ballast.

No.	Dimensions.	Cubic feet.	—Weight, lbs.— Per cross tie.	Per cu. ft.
1..	6 in. x 9 in. x 8 ft.	3.00	139	46
2..	6 in. x 9½ in. x 8 ft. 1 in.	5.21	162	50
3..	5½ in. x 9 in. x 8 ft.	2.75	145	53
4..	6 in. x 9 in. x 8 ft.	3.00	150	50
5..	7 in. x 10 in. x 8 ft. 3 in.	4.01	198	49
6..	5½ in. x 8½ in. x 8 ft	2.60	134	52
			154.5	50.0

Stone Ballast.

No.	Dimensions.	Cubic feet.	—Weight, lbs.— Per cross tie.	Per cu. ft.
7.	6 in. x 9 in. x 7 ft. 10 in.	2.94	150	51
8.	5½ in. x 9 in. x 8 ft.	2.75	138	50
9.	6½ in. x 9 in. x 8 ft. 1 in.	3.28	148	45
10.	6 in. x 9 in. x 8 ft. 1 in.	3.03	170	56
11.	6½ in. x 9 in. x 8 ft. 1 in.	3.28	185	56
12.	6 in. x 9 in. x 8 ft. 1 in.	3.03	148	49
			156.5	51

In tables Nos. 1 and 2 the cross ties are from subdivision No. 2 and are reported by A. Ames, Jr., Supervisor of Track.

TABLE NO. 2.—WEIGHT OF DECAYED YELLOW PINE CROSS TIES IN POOR CONDITION.

Gravel Ballast.

No.	Dimensions.	Cubic feet.	—Weight, lbs.— Per cross tie.	Per cu. ft.
1..	6 in. x 9 in. x 8 ft.	3.00	132	44
2..	6 in. x 8¾ in. x 8 ft.	2.92	162	55
3..	6½ in. x 8¾ in. x 8 ft.	3.16	163	52
4..	6 in. x 9¾ in. x 8 ft.	3.25	174	53
5..	6½ in. x 10 in. x 8 ft. 4 in.	3.75	184	49
6..	6 in. x 8½ in. x 8 ft.	2.83	156	55
			162	51.3

Stone Ballast.

No.	Dimensions.	Cubic feet.	—Weight, lbs.— Per cross tie.	Per cu. ft.
7.	6 in. x 9 in. x 8 ft.	3.00	135	45
8.	6 in. x 9 in. x 9 ft. 1 in.	3.03	155	51
9.	6 in. x 10 in. x 8 ft.	3.33	185	55
10.	6 in. x 9 in. x 7 ft. 10 in.	2.94	160	54
11.	6 in. x 9 in. x 8 ft.	3.00	172	57
12.	6 in. x 8½ in. x 8 ft. 1 in.	2.86	130	45
			156	51

In the tracks of the New York Central & Hudson River system the untreated yellow pine cross ties decay, as a rule, in the ballast from the under side to the top. There will be a few exceptions to this from cross ties containing the mycelium of the fungus in the central

portion before they are put into service. The cross section of the ballast, either of gravel or stone, on the New York Central & Hudson River tracks does not cover the top of the cross tie, even at the center, so the top is all exposed and in gravel ballast a portion of the sides and ends. The top of the cross tie exposed to the sun becomes dry, and with the included resinous matter a thin layer of the wood fibers does not absorb or retain sufficient moisture for the fungus to directly or indirectly disorganize the wood cells for many years. As a rule, the decay first occurs in the portion of the cross tie imbedded in the ballast and finally the upper portion loses efficient support from decay underneath. The sun and the air currents from many fast trains contribute to reduce the moisture in the upper surface of the yellow pine cross ties below that requisite for the growth of the fungus and it remains sound and firm for many years. As the illustrations show, under stiff rails mechanical abrasion of this hard layer of the upper surface of the yellow pine cross ties is slow and of minor importance. Under the weak 4½-in. rails besides abrasion there was mechanical disintegration of the wood layers or rings of annual growth, and over 40 per cent. of the yellow pine cross ties were reported as being taken out for cutting under the rail seats and injured by frequent respiking instead of decay.

One of the objections urged to preserving cross ties under the weak 4½-in. rails was that they were destroyed under the rail seats before they decayed. There was some truth in the objection, though the distinction between incipient decay and mechanical disintegration of the wood layers was not closely made. Since the introduction of the stiffer rails, the objection has practically lost its validity so far as yellow pine cross ties are concerned in New York State.

Mr. W. J. Wilgus, Chief Engineer of the New York Central & Hudson River Railroad, now estimates for the entire system that less than 5 per cent. of the cross ties are removed for causes otherwise than decay. Under some light rails still in use on subsidiary lines tie plates are used, particularly on the durable white cedar, which will increase their service many years. He used creosoted yellow pine cross ties on the Fourth avenue viaduct to raise the rails off the structure as at first constructed. The cross girders only permitted the use of 12 cross ties per 30-ft. rail, which are 6 x 8 in. and 8 ft. long. Tie plates are used under each rail seat. This furnishes wide tie spacing similar to the English and Continental railroads.

The stone ballast for each cross tie is limited to that between each girder about 15 in. in width and the same depth, including the bedding of the cross ties. The elasticity of the ballast is principally confined to its own mass, the structure deflecting much less than the ordinary subgrade of the permanent way. The cross ties are required to distribute heavier loads to the ballast than elsewhere on the line, and it will be interesting in a few years to see how the wood sustains the service. From the longer tie spacing there is a slight increase in the undulations of the rails under moving trains, and they have been provided with more efficient anchoring to prevent running. Otherwise after two years service of 60 to 80 trains per day there are no abnormal conditions which have developed in the cross ties in the track, and the indications are favorable for a long service without the wood checking and mechanical disintegration of the annual growths. The test is of as great value as though specially designed to observe the results of wide cross tie spacing in the distribution of maximum wheel loads under stiff rails. Yellow pine is a difficult wood to impregnate with creosote, though a large number of cross ties have been treated and are still good after 16 to 18 years' service. Some cross ties failed by mechanical disintegration of the annual growths of the wood. In most of such failures as came under my observation practically a radial section had been used under the rail seats, while cross ties from the same lot where the tangential section of the wood was used for the rail seats, the annual growths were not separated and the wood shattered. Too high heat in the creosoting cylinder is also injurious to the wood fibers, though the wood can be thoroughly sterilized below a temperature which is injurious to the wood structure.

Some yellow pine cross ties creosoted in 1884, which I had put down in the Grand Central yard, though shifted many times in their service and covered up partially the past few years, when taken out in 1900 for another change, a piece was split off from one of them and the wood seemed as sound and elastic as when put into service.

All of the wood examined was thoroughly impregnated. This is not always the case. Examining the creosoted cross ties after long service in England and the Continental countries it could be seen that their service was prolonged by the treatment, affording two grades of protection usually in the same cross tie to the wood structure. The first grade is by impregnating the wood cells with the creosote and the second grade by partial protection of interior sterilized cells. The two grades arise more from the difficulties of treatment rather than from principles intended in creosoting. The two distinct grades of preventing decay in wood afforded by the usual practice of creosoting are:

First. By the presence of creosote in the wood fibers furnishing continual sterilization as an antiseptic and protection by being impervious to moisture.

Second. The impregnated wood cells forming an exterior protecting zone to a mass of interior sterilized wood cells.

The first grade is the one sought to be produced by filling all of the wood cells with the creosote preparation and the nearer it is attained the better are the results for most places.

For some woods and large timbers all of the interior wood fibers have not been filled or sterilized in the creosoting cylinders and internal decay of the wood structure has occurred as though the wood had not been treated. This was in the earlier work, before it was understood that the exterior protection furnished excellent conditions for the growth of the fungi in the unsterilized wood cells. The sterilization of the interior wood cells is for the purpose of destroying all internal germs of fungi which they contained. In the extensive attempts to treat cross ties and timbers by immersion in corrosive sublimate—bi-chloride of mercury—the failure was due to the same cause. It was the growth of internal fungi, in the unsterilized wood cells, not external fungi, which destroyed the wood.

The second grade of protection is that afforded by the zone of treated wood to the wood cells, sterilized by treatment in the creosoting cylinders. The treated wood furnishes protection against exterior attacks of the fungi. The exterior protected wood, however, does not furnish subsequent sterilization to the interior wood cells, and they are liable to attacks of fungi from the exterior through checks in the treated zone. In resistant wood to the growth of fungi, like the yellow pine, the exterior zone protects the interior sterilized wood cells many years before decay ensues.

In the English creosoted Baltic pine cross ties, described more fully as to treatment in the March 8 issue of the *Railroad Gazette*, there was a small zone of unimpregnated wood cells which did not show decided decay for 16 to 18 years. As already stated, the cross ties, chairs and rails are removed from the main to subsidiary lines after 11 or 12 years' service. In Belgium where the oak cross ties remain in the creosoting cylinders much longer than is the English custom for the Baltic pine, the wood cells for each cross tie are more completely impregnated and the wood was sound and elastic after many years of service. In France the creosoted cross ties which were sound after 25 and 30 years' service, nearly all of the interior wood cells had been impregnated. A number of the creosoted cross ties after 15 to 25 years of service should be tested for strength, while others should be cut up and pieces selected to test any local impairment of strength and the manner in which it has occurred. This should be done for all the processes which have been long used for preserving cross ties. We would then have important facts derived from long experience of the way and manner the cross ties wore out or decayed in service.

The treatment of the yellow pine cross ties by chloride of zinc with a 2½ per cent. solution increased the brittleness of the wood, which split and checked in service, and has been used not as much for this dense and resinous wood as for the lighter and more open conifers. Its comparative cheapness has made it always an attractive antiseptic and by itself in warm and arid climates it has checked decay for some time in several woods used for cross ties and now is extensively employed in the Western States with excellent results. This is in accordance with what might be expected of the decay of the coniferous woods in that section by the fungus Lentinus lepideus Fr., its growth being less rapid in the warm and arid climates than in those of greater dampness. Many engineers have noticed the fungus in fruit on the pine cross ties and have identified it by the illustrations published. The number of persons who observe and can identify the more common forms of fungi are rapidly increasing and it is now much easier to gain information of this growth on cross ties than a few years ago.

There is still urgent need of observers in the forests, to notice the growth of fungi on the live trees, and also to check its growth on timber and lumber prepared for the market. As soon as the latter is better understood it will be of great benefit to the producers, as well as consumers. It is still unknown whether the fungus Lentinus lepideus Fr. has been found in fruit on growing trees. I expect it will be, on large limbs at the top of the tree. From the character of the growth and the small lower limbs of most conifers in dense forests, the limbs die or are broken off when small, and heal over by the growing wood layers so quickly shutting off the air supply, that the growth of the fungus is too slow for fruiting in such cases. The traces of mycelium which are found are not sufficient for identification at present. On cross ties in the track I have found the fruiting to take place from the decay which started from the region of the small decayed limbs. In the yellow pine forests I have found the fungus fruiting upon charred stumps in the immediate vicinity of the decayed limbs.

Another feature which makes it so hard to find the fungus Lentinus lepideus Fr. is that soon after fruiting it is destroyed by insects and only the decay of the wood is left to indicate its destructive work. It has a very extensive habitat, quite equal to that of the growth of the conifers of the genus Pinus.

The decay of the yellow pine cross ties by the fungus Lentinus lepideus Fr. is quite different from the decay of the untreated Baltic pine cross ties by the same fungus in Russia. In that country of cold winters, with a short summer season, I was surprised to find decay of wood so rapid. The interior structure of the untreated cross ties seemed to be attacked and rendered unserviceable in three or four years, causing the spikes to lose their adhesion. The handling of the cross ties from the forests appeared to be excellent, the bark was removed from the timber as soon as felled and the wood was clear and not in the least discolored in the sapwood by fungi.

The Baltic pine is not nearly so resinous and resistant to the fungus Lentinus lepideus Fr. as the yellow pine in this country. Baltic pine cross ties treated with chloride of zinc were only serviceable six to eight years, about twice as long as the untreated. The chloride of zinc does not unite with the wood fibers but leaches out by the moisture in the ballast and the rains, and leaves the cross ties without protection.

Near St. Petersburg, a number of specimens of Lentinus lepideus Fr. were found fruiting in cross ties which had been treated with a 2½ per cent. solution of chloride of zinc after six to eight years' service. In this case the fibers of the wood were once sterilized, but not afterward protected from moisture, leaching out and reducing the strength of the antiseptic until it was unable to check the growth of the fungus and subsequent destruction of the wood.

Chloride of zinc does not embody as many phases of preservation as creosote, for the heavy oils of the latter are insoluble in water and are retained by the wood fibers. Experiments were to be instituted at St. Petersburg of subsequent treatment by creosote to the Burnettized cross ties to see if that would not retain the chloride of zinc and increase their service. Such a method has been employed on different woods with excellent results. The Russian cross ties of Baltic pine are principally pole ties and the majority in the vicinity of St. Petersburg were protected under the rail seats by heavy tie plates.

In whatever country one travels he finds the subject of cross ties receiving more and more attention year by year. There is a feeling that the durability of the wooden cross ties should be increased for a longer period of years, owing to the increasing traffic and scarcity of timber. Even in this country, with its recent virgin forests, pole ties of second growth white oak, once so much in demand, are no longer obtainable as a partial supply. Sawed white oak only has a maximum life of eight years in the railroad tracks in New York State, owing to the rapid decay around the spikes and under the rail seats. The decay is entirely different from that of the yellow pine. Red oak renders a service of about four years as cross ties for main lines.

The New York Central & Hudson River Railroad Company have for many years used a large percentage of the yellow pine cross ties with other obtainable woods. The average number of cross ties per mile of all kinds of wood was 293 for the past 10 years. This average is above the maximum until after the year 1893, then for five years there was an increase, more being used per rail, owing to the great increase of traffic. In 1899 an average of 233 were used per mile, as cross ties were not promptly obtainable, while for 1900 the average was 270.

The increase of two to three years more life for the yellow pine ties under the stiffer rails than was obtainable under the 4½-in. 65-lb. rails is an important gain in the reduction of the mechanical disintegration of the wood fibers under the rail seats. This has not been gained by any limitations of the wheel loads or the traffic. It is a legitimate gain from the better distribution of the moving wheel loads by the stiffer rails. The wheel loads have doubled on the stiffer rails as well as the volume of traffic. The gain is favorable in every phase of railroad economy and operation.

The evidence that the cross ties do not cut under the stiffer rails as rapidly as formerly under the low sections is not confined to the New York Central & Hudson River Railroad. It is found to be general on all roads where the stiffer rails have been long enough in service to furnish comparisons. This was confirmed by the replies to the question, "Do the ties cut under the heavy rails as rapidly as under the former light sections?" sent out by the International Railway Congress for the Paris session, 1900. The universal reply was "No," not even under a much heavier traffic. This fact has renewed the interest in cross tie preservation in the United States and means and measures to increase their service and avoid the waste in timber are receiving more consideration than for some years. Practical forestry, conserving, growing and harvesting the timber and subsequent treatment of the wood are projects now under discussion.

The Gokteik Bridge.

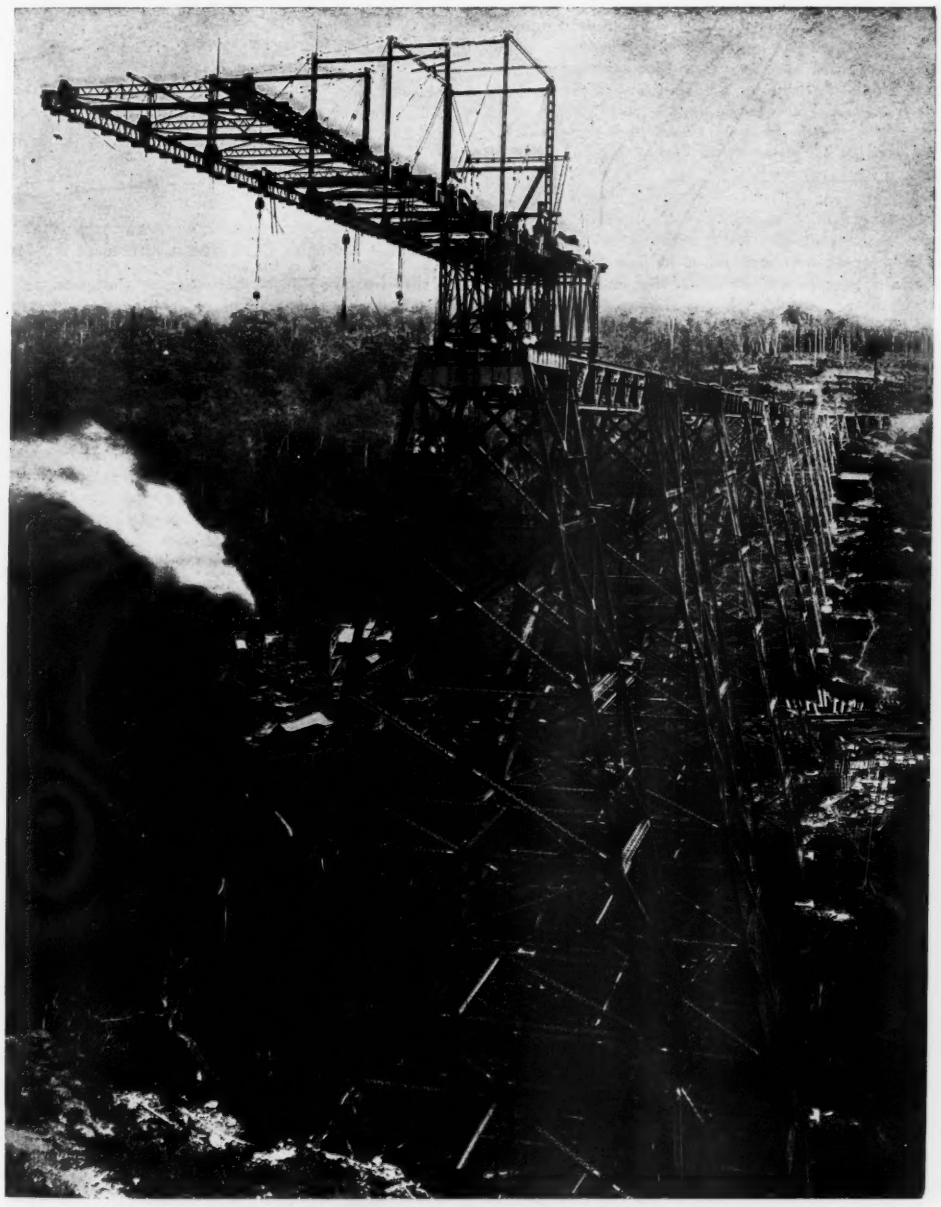
BY J. C. TURK, *Engineer of Construction.*

[In the *World's Work* for September appears an article concerning the erection of the bridge over the Gokteik Gorge, now so famous. The article is written by Mr. Turk, who had charge of this work for the Pennsylvania Steel Company. It is "popular" in style, with many fine illustrations from photographs, and below we print a few extracts. The bridge has been so frequently described that a more strictly technical account is hardly called for now.]

With Mr. Deuchars, Chief Engineer of the Mandalay-Kunlon, I left Rangoon for Maymyo, 40 miles northeast of Mandalay and 40 miles from the Gokteik Gorge.

Going up to Maymyo (only 10 years ago a hornet's nest of *dacoits*, but now a thriving village, half European and half Burmese, soon to be the headquarters of the army of British Burma), we criss-crossed up the precipice on the east side of the Irrawaddy at a grade of 1 ft. in 25. In some places it was too steep for curves: switchback reversing stations came every other mile. The scenery was marvelous. Tumbled masses of purple

teak-covered hills rolled away to the horizon, and the valleys were rocky canyons often a half mile deep, with icy streams at the bottom from slim white cataracts that poured down the canyon walls. At one point the train crawled along the face of the rock with a sheer drop away of 1,500 ft. from the outside of the shelf. All the way up to the plain in the Shan Hills where Maymyo lies, these spurs of the Himalayas outdid the Sierras in picturesqueness. On the plain itself, and indeed throughout the Shan States, though it has belonged to the Indian Empire for only 15 years, the country has already been reduced to systematic order; the former soldiers of Thibaw, the last of the Burmese kings, are now building better roads than I have ever seen in my native State in New England, and the reformed *dacoit*, as he cultivates his rice field and patches up his irrigation ditches, can see the steam roadroller lumbering through jungle that he shared not long ago with elephants and tigers. The whole province, about as large as France, is the most prosperous in India. . . .



The Great Traveler of the Gokteik Bridge.

We arrived at the Gorge, where I was at once impressed with the stupendous natural bridge under which the Chungzoune runs, and with the engineering skill of Mr. Deuchars, who formed the plan of taking advantage of this formation and running the viaduct on its crest. By building across the natural bridge a viaduct 320 ft. high, it was possible for the railway to reach a natural shelf on the face of the cliff, up which it could climb on a steep grade to the top of the plateau some miles away, there to turn sharply to the northeast for the Kunlon Ferry. Already, when I reached the Gorge, the concrete piers for the trestle work had been built—the piers were not in our contract—and stretched in two apparently converging lines across the valley. Everything, in short, was ready; nothing remained but to secure workmen, ship our material up from Rangoon—where it was arriving from New York by the American-Indian line—and begin operations.

The first work to be done was the hiring of laborers. . . . I started off on my hunt for labor—first to Mandalay, then back to Rangoon, and finally to Calcutta. In all of these places the method of securing laborers was the same. Upon the advice of English engineers I had met, I sent for native *mistris*, or foremen, and had them bring their gangs to me one at a time—from these I made selections. At Mandalay and at Rangoon I managed to pick up about 10 sets of native riveters, mostly Sikhs and Punjaubis, and a small gang of Punjaubi coolies; and in Calcutta I secured a small army of *khallassies*, or riggers, and a gang of Gujerati lascars from the Bombay side—enough to start with. At Rangoon again, on my return, I met Mr. Louis N. Gross with 20 American workmen from Steelton. Mr. Gross, who had been foreman of construction on the great Southern terminal in Boston, the new Niagara arch, and other great contracts of the Steel Company, was to superintend the actual putting together of the viaduct; and the men, all of whom had worked at Steelton, reinforced by 10 others who came out later, were to do the work. Not only was the plan of the bridge made in America, and every girder, and brace, and bolt manufactured here, marked for a definite position, and shipped directly from New York, but every bit of steel in the structure was put into place by some one of the 30 skilled workmen from Pennsylvania; the natives simply shifted material, riveted and painted. . . .

Finally, we were able to begin work on the viaduct the first of February, 1900. Any great engineering project carried on 15,000 miles from home is bound to be full of difficulties, since all kinds of unforeseen accidents are likely to occur. At Gokteik we had no sooner emerged from the rains than we were confronted with the problem of handling, sorting and storing our material at the starting point of the viaduct in a cramped, inconvenient spot on the steep slope of a hill. In America a few carloads of material can be shipped as they are needed, but out there a second steamer load—comprising a full third of our material—was upon us before the first load had been properly stored, and just as we were establishing our plant and beginning actual work in the field. As the material came in from Mandalay, our steam derricks whipped it out of the meter-gage freight cars, and swung it over to the smaller derricks for final disposition; and coolies swarmed about with smaller pieces like ants in a stirred-up ant hill. The work went on with such speed that the native engine drivers and train hands could not shift empties in time to keep clear of the rush. So when too many of them accumulated, we picked them up with the 15-ton steam derrick, and set them down on the bank—where the drivers of the switching locomotives would discover them, 50 ft. below the level of the track, piled up like empty drygoods boxes. . . .

In erecting a high viaduct, or even in building a tall city "sky scraper," the difficulty increases roughly as the square of the height, a fact recognized by Mr. J. V. W. Reynders, who drew the detail design and who oversaw at Steelton the manufacture of the material, and also by Mr. F. W. Cohen, the steel company's specialist in machinery, who designed the appliance with which the actual construction was done. The material, therefore, was specially adapted for its use, and the appliance, a gigantic steel traveler, or overhanging crane, was of original pattern and the largest ever built. The traveler ran out on the rails of the Mandalay-Kunlon to the shelf from which the viaduct started, and overhung the piers upon which the first tower was to stand. It was 225 ft. long and 60 ft. high, weighed nearly 100 tons, and had the tremendous free overhang of 164 ft.

The great traveler was first constructed directly upon the track on the embankment at the south end of the bridge; then, as soon as it was in working shape, the material for the first tower was passed out through it in proper order, lowered and bolted into position in readiness for the native riveters. Then, as soon as the tower had been pretty well riveted, the big girders for the intervening space between the newly-constructed tower and the abutment on the bank were swung out; the longitudinal stringers and the cross floor beams followed; ties and rails were laid for the trains with material; and tracks were laid upon the girders for the traveler to run on. . . .

In all this work with the traveler the American workmen proved so efficient as compared with the natives, that, roughly speaking, I should consider one American equal to at least four natives. Divided into castes and subdivided into trades, the natives were able to do but one kind of work; though in an American rivet gang there are but three men, all capable of doing any part of the work, the Indian natives are obliged to have in their gangs a hammer man, a snapman, a man to hold the dolly-bar, a man to heat the rivets, and one to pump the bellows. The bellows men cannot heat rivets; the rivet-heater cannot swing a hammer; the hammer man cannot hold the dolly-bar—and when the gang are obliged to move, they have to wait for the *khallassies*, or riggers, to rig their stagings. When the painting began on the viaduct, I found the painters, too, quite useless without the *khallassies*. Good workers at their trades they were, however, all of them, the riveters from Oudh and the Punjaub, used to bridge work, and the *khallassies*, sailors mostly from coasting vessels or P. & O. steamers.

Usually, on Indian bridge work, the British engineers put a thousand or two thousand of these natives under one or two Europeans, for they are as docile as sheep, and have the same respect for their European overseers that sheep have for a collie; but we introduced the innovation of having white men work. On the traveler, on the material as it went up, on the topmost points of the rising towers to connect the new pieces as the crane swung them up, the Americans—and a few British and German sailors I had picked up, with one North Carolina negro who spoke Hindustani—worked hard, to the measureless surprise and admiration of the coolies, so that as soon as the construction of the viaduct got well under way, operations went on with tremendous rapidity, some of the 200-ft. towers, much like New York skyscrapers, going up in three or four days. When one thinks of the slow progress of an office building, rising gradually week by week, the speed of these Steelton workmen with their train of coolies may be comprehended. One whole month, however, was spent on the great, double, 320-ft. tower directly on the natural bridge at the lowest point of its hollowed back. From 7 to 12, and from 1:45 to 6, the men worked. Over the traveler was spread an awning for protection from the sun, but as much of the work was done in the open, the men, dressed as thinly as possible in khaki, had to depend on white pith helmets to protect them from sunstroke, for sometimes the temperature rose to 120 deg., and at all times the Indian sun at midday is dangerous. But without intermission, except when the monsoon blew, or when, in the rainy season the whole sky emptied itself into the valley, the bridge was pushed forward. No heat daunted the men, and in the rainy season, from July to October, the rain had a comfortable habit of falling mostly at night.

When the day's work was over I usually settled up affairs, attended to correspondence, and developed photographs; the men read or wrote letters, or played poker—and some of them drank whisky and fought. The natives watched the fights much in the manner of the politic Dearsley's coolies, in frightened groups, but as the fights were never serious, the combatants were allowed to pummel as long as they pleased. . . . A few of the men, as I have said, rashly drank whisky, a perilous indulgence in that climate, and became sick, discontented and troublesome; the sober and industrious ones, except for an occasional touch of fever, retained excellent health, saved their money, and returned with savings of over $1,000 apiece for their year's work.

As the work progressed we received constant visits from Government and railroad officials. Among them, of course, were a few subordinate engineers, disgruntled at seeing foreigners encroaching on their formerly exclusive ground, and some who looked with disfavor on a contractor's going out to erect his own work—for most of the great bridges in India have been built by Government engineers of material shipped from England—but, in the main, the officials I met impressed me strongly with their splendid training and great ability, their friendliness to our undertaking, and their amicable attitude toward the United States. Their visits, too, agreeably broke the monotony of life in the Gorge, for ex-

cepting an occasional caravan crawling down the old trade route from China with bales of pickled tea, our region was an almost absolute wilderness.

In December the viaduct was completed. The last rivet was driven; the last coat of steel-gray paint was put on; the natives were paid off and sent away with the usual *chit* or recommendation; the big traveler was removed; and the Americans were sent home with Mr. Gross, who was wanted at the East River bridge. The ground was cleared up, the track was laid across the viaduct, and the long steel structure was ready for the tests of the Railway Company.

There remained but one task. In neatly arranged piles by the side of the line lay the parts of the great traveling crane, the derricks, the cables, and all the tools used in the construction of the bridge. I hated to ship them all the way back to Steelton, and yet they had been a heavy item in the total cost of the structure—they had to be disposed of to the best advantage. After considering a while, therefore, I let it be known that the material was for sale. At once the Railway Company proceeded to snap up a selection of the tools; merchants from Mandalay and even from as far away as Rangoon sent representatives to buy; and from the collection of forges, anvils, and so on bought by the hard working, tiger shooting, much beloved Dr. Leeds, the American Baptist missionary at Thibaw, for use at his mission one would have believed the reverend gentleman on the point of becoming a bridge builder. Altogether I managed to dispose of all of the stock at a very appreciable profit; the sale had been a decided success.

The tests lasted two months. Heavily laden trains were run over the viaduct, and expert engineers examined every detail. After the most thorough scrutiny the railway accepted it, expressing complete satisfaction, and the Secretary of Public Works offered the congratulations of the Government of India on the successful completion of the undertaking.

The New Compressed Air Motors for City Traction.

As a result of extensive and, in the main successful, experience with compressed air motors in New York City and in Chicago the Compressed Air Company has recently been making a number of very interesting modifications and improvements in its motors for street work. The apparatus as used heretofore was fully described in the *Railroad Gazette* for March 9 and Nov. 23, 1900. In designing those early motors the steam locomotive was taken as a model and the wearing surfaces were proportioned accordingly. It was found, however, in service these proportions were inadequate. The conditions under which the motors must work were severe and there is more dust and dirt to wear the moving parts, and especially lubricated parts.

At the same time that the wearing surfaces have been increased the power of the machine has been augmented. In the earlier motors, for street service, the diameter of the cylinders is 6½ in., with a stroke of 12 in. The diameter has now been increased to 8 in. with the same stroke, but with driving wheels 27½ in. in diam. instead of 26 in. As the mean effective pressure has been kept the same, the increase of tractive power is as 19.5 to 28.

In order to have the same radius of action as before it has been necessary to increase the storage capacity in proportion. The new cars, which are being delivered to the Rome City Railway, of Rome, N. Y., have a storage capacity of 79 cu. ft., instead of 56 cu. ft. as before. This increase of storage capacity is almost in exact proportion to the increase of tractive power. Judging from the performances of the cars of the Rome City Railway the storage gives from 12 to 14 miles at a speed of about 13 miles an hour, including stops.

With the increase of power in the cylinders stronger attachments to the frames became necessary. The number of bolts by which the cylinders are held is increased and wedges are introduced after the fashion of the locomotive fastenings, and the flanges are made stronger and heavier.

The axles have been increased from a diameter of 3½ in. to 4 in. Cast steel has been substituted for cast iron in the driving wheels centers, and the thickness of the tires has been increased from 1¼ in. to 2 in. The crank pins have been enlarged and the eccentric rods have been made heavier to do away with the springing that had caused some disturbance in the valve motion. The bearings on the eccentrics themselves have also been widened to obviate heating that formerly gave some annoyance.

The valve motion has been overhauled and practically redesigned. In the earlier valve motions the main valve was driven by a link motion with two eccentrics, while the riding cut-off valve was driven by a separate eccentric and was made to vary the admission under the control of the motorman. It was found in practice that this was an uncalled for refinement. The training of the men on the front platform of these cars was such that they failed to appreciate the value of the variable cut-off with the result that it was entirely neglected and the engine was worked through the run just as it was started. The third eccentric has been abandoned, and the riding cut-off valve is driven from the crosshead through a rocker. This has greatly simplified the valve motion, has lessened the number of parts and connections and made it possible to secure larger bearings. With this new arrangement the riding valve is made to give a constant cut-off at one-sixth the stroke. This is maintained at all times, both at the start and on the run. In order that the start may be made promptly and with a quick acceleration, a by-pass valve is used whereby air is admitted beneath the main valve and through it to the cylinder for about seven-eighths stroke. This admission is controlled by a separate valve and handle on the platform. It is closed as soon as the car is in motion. The reverse lever is, therefore, always held in the extreme limit of its throw and an economical point of cut-off is insured without dependence being placed upon the judgment of an untrained man.

Indicator cards taken from the new cars show a remarkable fineness of lines and a distribution of the various elements of admission, expansion, exhaust and compression that are models of their kind. One of these cards is reproduced, Fig. 1.

The reversing connections have also been changed. In the earlier types of motors the reach rod was designed on the locomotive plan and gave annoyance by vibration under the motion of the car. It not only disturbed the proper distribution of the air, but its rattling added noise. This rod has been done away with and a tension rod substituted therefor. This rod runs out in each direction to the end of the car where it is attached to a tiller cable running over a sheave and fastened to the reverse lever. The whole is kept taut by turn-buckles and, as it works under tension only, it can be made much lighter than the old form without having any effect on the action of the valve as a result of vibration.

Another change is to be found in the form of the valve itself. As first made it was short and the air to the port of the main valve passed over its edge. The rapid movement of this air down over the end of the rider tilted it and caused it not only to wear away at its ends but also to cut into the back of the main valve. The result of this double action was that it soon ceased to act as a cut-off valve, and leaked badly, practically allowing air to enter the cylinder for the whole length of the stroke. This trouble has been entirely cured by lengthening the rider and allowing the air to pass through a port cut in it instead of past its edge. Again the valves were formerly held to the stems by nuts that were liable to work loose. Yokes of the regular locomotive type have been substituted, and the top of the valve chest has been cut away on a slope so that the stems can be slipped through the glands from the inside.

The cylinder has been shifted nearer to the end of the frame, thereby making it possible to do away with the rocker connection for the main rod. The crosshead has also been modified to the form having a removable side plate so that the gibs can be lined and adjusted with greater rapidity than was possible with the old form of U-shaped crosshead. Cast steel is also now used for the guide yoke.

The lubrication of the cylinder has also been changed by the introduction of a lubricator that acts only when the throttle is open. The old method gave a continuous feed, with the result that, after standing for a time, the first exhaust, on starting, was accompanied by a squirt of oil. The discharge of the exhaust has been changed from a shallow pan at one end of the car to an ordinary exhaust head set on the roof. A drip pipe from this leads to a small catch tank beneath the car from which the water can be drawn at the end of a trip, thus doing away with water dribbling down on the street.

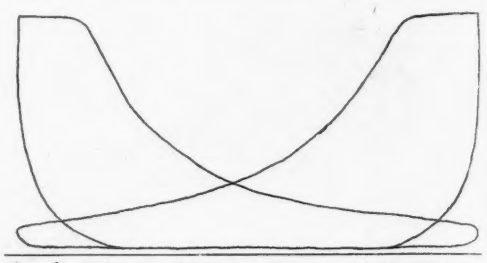


Fig. 1.—Indicator Card from Compressed Air Motor.

Perhaps the most important changes of detail have been made in the heater. There has been no change in the principles of its action, but merely in details. It is still a tank of hot water through which the air is made to rise on its way from the storage bottles to the cylinders and after passing the reducing valve. In the early heaters the pipe leading from the storage was perforated with the perforations at the bottom and was set close to the bottom of the heater. The result was that the jets of air, impinging upon the metal of the heater tank, bored holes about ½ in. in diam. into the same. This was due to the combined contact of air and water by which a rapid oxidization was brought about. The air escaping up the sides of the pipe also lodged on its upper surface and caused pitting at that point as well. To remedy this difficulty the perforations were turned upward and a deflecting plate placed in their line of escape so as to break up the stream and secure a proper admixture with the hot water and a corresponding amount of heating. (Fig. 2.) This was only partially successful as much of the air would

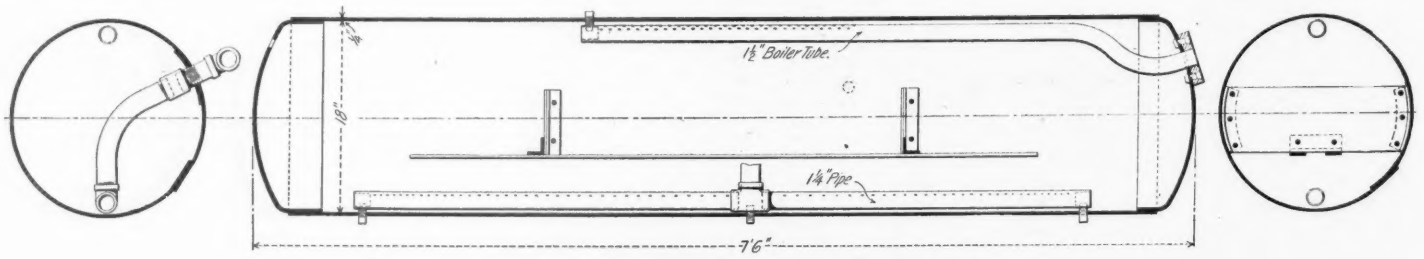


Fig. 2.—Heater for Compressed Air Motor Car—April, 1900.

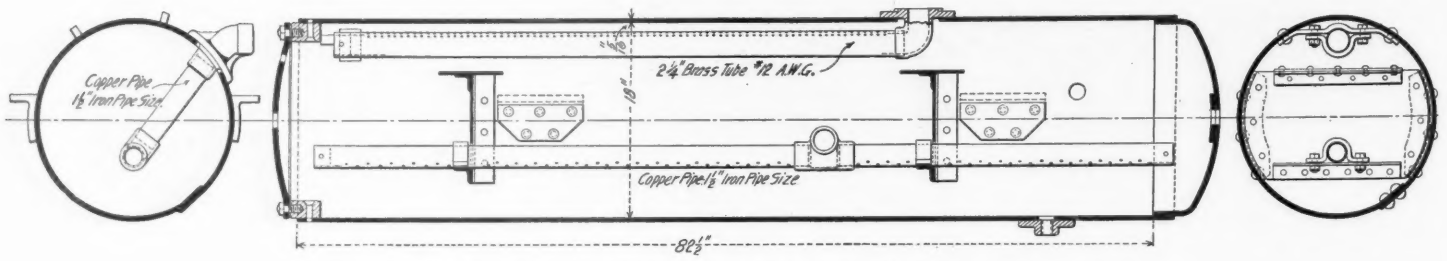


Fig. 3.—Heater for Compressed Air Motor Car—The Latest Design.

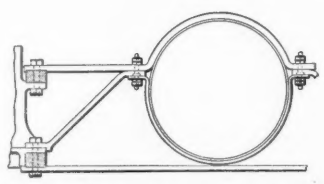


Fig. 4.—Heater Support—April, 1900.

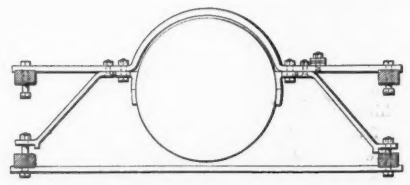
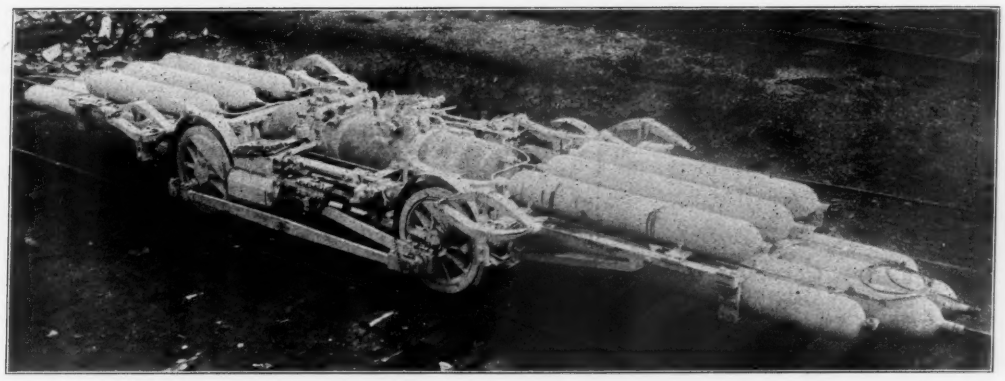


Fig. 5.—Heater Support—April, 1901.

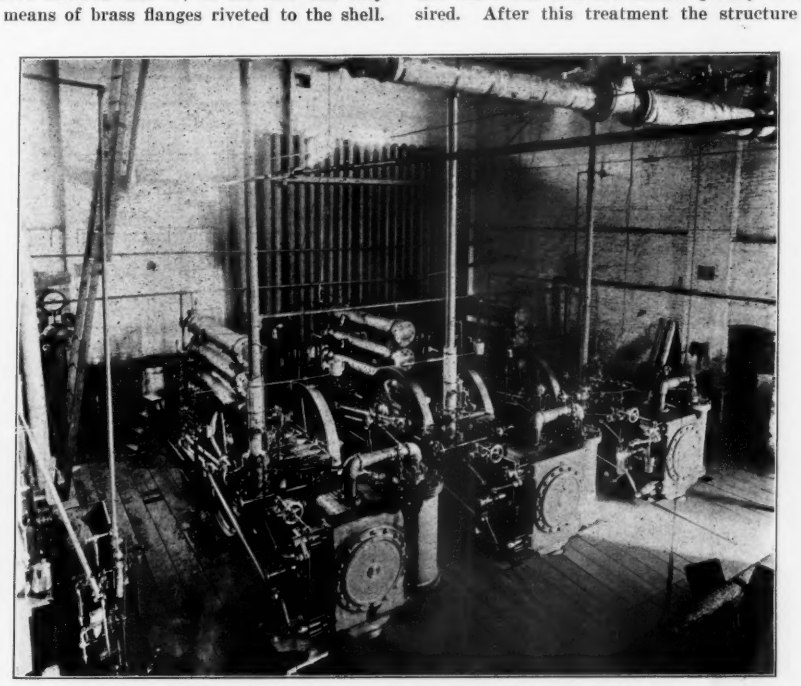
dodge past the deflector plate and escape to the cylinders unheated. In addition to this the pipe fastenings were not as secure as they might have been and one of the pipes breaking loose and wearing a groove in the bottom of the shell caused the rupture over which there was an attack of newspaper hysterics a few months ago.

The throttle pipe was also perforated at the top and was set so near the top of the heater that it was necessary to put a pocket in it in order to get it conveniently out at the curved head. This pocket served as a place of deposit for entrained water, which caused annoyance by passing into the cylinders at starting. The shell of the heater was also entirely closed with no chance for inspection or repairs.



Truck and Storage Flasks of the New Motor of the Compressed Air Co.

In the new heater all of these points have been remedied. (Fig. 3.) The inlet pipe has the perforations at the bottom, but it is raised to such a distance from the shell that the incoming air will not strike the metal and to stop the pitting of the pipe itself copper has been substituted for iron as a material. The pipe has also been substantially fastened to the shell. The shell has been changed so that one head is now bolted on for easy removal and repairs, while a peep hole has been placed at each end for inspection. The throttle pipe has been made straight and is taken out through the top by means of a casting having a drip hole to allow entrained water to fall back into the tank. In the old heater all of the connections were screwed into it; in the new one they are made by means of brass flanges riveted to the shell.



Compressors in the Power House of the Rome City Railway.

Arrangements have also been made whereby, instead of using cold air for starting, as in the earlier motors, it is now heated in the same manner as that used for the regular working.

Finally, the method of carrying the heater has been greatly improved. Formerly, it was supported by a sling to which it was merely clamped, and thus held to one of the frame cross braces. (Fig. 4.) Oil and the motion of the car caused it to work back and forth to the detriment of the pipe connections. This will now be impossible in that there are two angle irons, riveted to the shell, by which it is bolted to the strap clamping it to the cross-brace. (Fig. 5.) Its support is further strengthened by a diagonal brace dropping down and taking hold of the lower rail of the frame.

Five of this new type of motor are now at work on the Rome City Railway at Rome, N. Y., and are running with remarkable smoothness and quietness.

Locomotive No. 3, a four-wheel engine with a four-wheel tender, of the Furness Railway, England, has been in use continuously for 54 years (1846-1900), and it is now to be preserved on a pedestal, as a relic, at Barrow. This engine is one of the well-known Bury type, which has been described in the *Railroad Gazette* (March 23, 1894, and June 4, 1897). The engine and tender together weigh about 32 gross tons.

The Master Blacksmiths' Convention.

We gave last week a partial report of the annual convention of the Railroad Master Blacksmiths at Denver. Below will be found extracts from still other reports and papers presented at that meeting. Our reporter has failed to give the names of the speakers in several cases:

ALLOYED TOOL STEEL.

H. W. Rushmer.—. . . A very large per cent. of the alloyed tool steel used in the past was an alloy of iron, carbon, tungsten and manganese, but recently some of the other metals are used with good results. One notable instance is the so-called Taylor-White steel with patent specifications calling for: Carbon, 1.85; chromium, 2; tungsten, 8.5; manganese, .15; silicon, .15; phosphorus, .025; sulphur, .03, and at times molybdemium is used instead of tungsten, or both may be used. The tools are given a high-heat treatment, the temperature ranging from 1,725 to 2,000 deg. F. The tools are then cooled rapidly or slowly, according to the hardness of the metal to be machined, or they are placed in a lead bath and when they have fallen to the same temperature as the bath they are taken out and are chilled quickly or slowly as desired. After this treatment the structure of the steel gives a non-silky appearance and is coarse grained, frequently interspersed with sparkling grains.

In some places the abuse of alloyed steel is remarkable and if the steelmaker abused the steel in the same manner he would not produce a perfect bar in a lifetime. He takes ample time to heat uniformly and thoroughly, and does not attempt to forge these ingots down to the finished bar in a couple of heats as he would the carbon steel. So let us profit by their experience and use the blast sparingly and heat uniformly and thoroughly, bearing in mind that quick and uneven heating is productive of strains. Heat the steel until it is perfectly plastic and malleable, do all the forging between the range of a bright orange and orange color; it will be noticed that one of the peculiar properties of this steel is that it chills down much quicker than carbon steel.

In working the steel on the anvil it should be turned quite often, in fact, whenever possible, for if it remains too long on one side it becomes chilled on that side, and if forged in this condition it will have a tendency to crack. If these conditions are carried on a little further, such as one part in a perfectly plastic condition and the other non-plastic, that part which is non-plastic will not draw as fast as the plastic part and at the junction of these two conditions the particles or grains will slide over or cut past each other until the tension becomes sufficient to rupture.

The old style diamond point tools are made by first drawing the points out nearly square, then they are placed on the corners and forged into a diamond shape. This is very bad practice with a steel of this kind, for they will almost invariably be split or worthless. Instead of these make the half diamond points, which can easily be done by drawing the points out square and then cutting the outside corners off with a sharp chisel, thereby leaving a stronger and better tool. When tools fail to hold their cutting edges, either by crumbling or giving down, it would be well that we recall the past treatment, for possibly we have injured the quality of the steel by soaking it too long at a higher temperature than permissible, or by working it too cold, which would have a tendency to crush or shatter the steel, or perhaps it was spoiled by trimming too close with a dull chisel.

It is claimed by some that these steels can be heated to a high temperature and still retain their quality, but the reverse has been my experience, and even with careful treatment it will deteriorate rapidly, especially the higher tempers. A good hammering will partially restore the quality, for some of the best tools we ever had were forged out of old, worn-out tools. It may be asked by some why are these alloyed steels so hot, short and brittle? Now this is hard to answer, but we must remember that these rarer metals are very hard, brittle and in some instances almost friable, and that these properties are imparted to the steel, though somewhat modified. These alloys may be but mere mechanical mixtures; if such, the metals have not entered into definite chemical compounds, and are not united in atomic proportions, or again the constituents may not have sufficient affinity. If these dissimilar metals are not united in their atomic proportions, and, when heated and then permitted to cool down and one of the constituents has the property of cooling down quicker and shrinking more than the others, this would probably cause weakness.

One of the difficulties for the steel makers to overcome is the tendency of the steel to split after it has been forged a few times. Probably these little strains and rents take place in casting the ingot or in drawing it down into bars. These defects cannot be detected for awhile, but will frequently make their appearance after the tools have been dressed a few times. Heating a few inches higher up than is required with the carbon steel, and holding it perfectly level on the anvil so as to reduce vibrations to a minimum, will, to some extent, prevent these strains from opening up. Again, for instance, we take the hardest steel and have a long tool; it is heated to the proper forging heat on the end, and near the center probably the temperature will be about 570 deg. F., or, as termed by some, "the fatal blue;" it is placed unlevel on the anvil, a blow is struck with the sledge; a sudden vibration takes place which if severe will cause the tool to break instantly in that part which was heated to the blue. Upsetting the tool should be avoided by all means, and if persisted in will only result in failure.

A marked improvement can be noticed in those tools where it is possible to give them a good hammer refining, providing the grain is not raised again in heating for hardening. . . .

If the tool dresser is compelled to use sulphurous coal it can be counteracted a little by turning on the blast rather strong, and when the coal is all coked and fairly glowing, the blast can be turned off and a piece of iron laid in the fire which will collect most of the sulphur which he will notice to be a coat of white or yellow, on the piece of iron; if necessary repeat this operation until the fire is reasonably free from the deleterious element.

All alloyed steels can be annealed by packing in air-tight boxes or muffles and then placing them in the furnace and maintaining an even temperature, of say about 1,200 deg. F. for 24 hours, then permitting it to cool down slowly. One exception to this rule that I would make would be high manganese steel. Charcoal or any of the carbonaceous substances will answer for the packing material. Sometimes each individual piece of steel is wrapped up in asbestos and is packed in the box with layers of charcoal between them. After being annealed they show a much finer and velvety texture. . . .

The very hardest steel if not hard enough to cut the material can be heated to a good orange color and quenched in the blast, and in the absence of this, oil can be used for the quenching. On those steels which are medium hard the blast, the oil, or hot tin or lead can be employed. The tin or lead is just brought to the melting point and the tools are partly chilled in this and then taken out and placed in the oil or blast. The mildest steel cannot be quenched in the blast and must be tempered in the oil and water. When tempered in the water they are heated carefully, the cutting points are dipped in the water, drawn to the straw color and then placed in the oil so as to prevent the temper from running. A good annealing will relieve many strains, and in some steels a good annealing will place the steel in such a condition that it can be tempered in water, which gives it great endurance.

Now a word with the machinist. He does not always exercise his best judgment in grinding and using the tools made from this steel. He fails to remember its peculiar properties and consequently when the tools fail to perform their duty he either blames the steel or the tool dresser. He will often grind his tools with too much rake and smear which leave very little strength or back-

ing to support the cutting edge, or in his hurry he will press the tool with full force against glazed emery wheel which will result in a great number of small cracks and the tool can be considered worthless.

TOOLS AND FORMERS.

Daniel Fitzgerald (C., M. & St. P.)—The blacksmith foreman who cannot devise and get in operation tools for various labor saving machines is not in it. He must be able to get up tools for different work on forging machines, also shapers and formers for his bulldozers. Then he must have dies and tools for shaping and welding different forgings at steam and Bradley hammers, punches and shears, etc., all of which must be kept busy and properly equipped with dies to do the different kinds of work. Then, also, tools and formers for the anvil must not be forgotten. A great deal of work can be done at the anvil at a great reduction in the cost of labor by a little expenditure in the way of hand tools, as, for instance, at the Milwaukee shop at West Milwaukee, there is a tool for the anvil which was originally made to bend ⅜ eye bolts, but which has been utilized for different classes of bending until now we bend grab hooks of square iron, gate hinges, gate hooks with eye on one end, hook on other, all kinds of round hooks as large as 3½ round; in fact, we are continually finding something new for this tool, all of which goes to show that if you once get started with tools they will keep on leading you into something new continually. Taken altogether for different machines we have about 975 different dies, and we keep adding to them all the time.

APPRENTICES.

S. Wren (Southern Pacific).—The qualifications for a young man to become a blacksmith are: He should have graduated from the grammar school and be not less than 15 years of age. The master smith should not only encourage but teach the young men the method of applying the knowledge they have acquired to mechanics; such as mensuration of areas, lines and surfaces; strength of the metal they are manipulating, also to solve the triangle, and when at leisure, they should practice drawing. It is absolutely necessary that a blacksmith should thoroughly understand drawing and be competent to make and read intelligent sketches. Five of the apprentice boys in the blacksmith department of the Southern Pacific shops are correspondents of technical schools. I know of no trade that requires a technical education more than the blacksmith trade.

The blacksmith trade should be a selection of his own choice. With these qualifications, and the master smith doing his whole duty, the apprentices, if they are in shops where there is a variety of good forgings produced, and the young man has taken the proper interest, he should become a first class mechanic.

Blacksmithing is an art not easily acquired, and as yet has not been reduced to a science; we cannot lay out our work and cut to lines as do other mechanics. I claim that in order to become a general blacksmith, apprenticeship should not be less than five years.

Mr. E. T. Sharp tersely remarks that if some of us do not take an interest in apprentices in the shop which we control, we will soon be without blacksmiths. Good workmen are a very rare article to be found in this vicinity. In my opinion, where there are 10 or 12 smiths it would be right to have two or three apprentices continually; it would not only be beneficial, but would produce a better class of mechanics.

G. F. Hinkens (Westinghouse A. B. Co.)—The question of the apprentice is almost as much a sociological question as it is mechanical. It is a striking fact that our blacksmith apprentices are drawn in a very small proportion from boys who have passed the grammar school, and it follows that boys of American parents and educated in the grammar schools are withheld from learning the blacksmith trade. Two results will naturally follow: The number and character of the smiths will suffer change in comparison with other mechanical pursuits. And this is just what has taken place, and the same has seriously affected the intellectual standing of the smith. The present trend of affairs in relation to the commercial side of the subject (this in conjunction with the drop hammer, bulldozer, and other modern machinery in the blacksmith shop) has made it a place for specialists, or, in plain words, the handy man. In earlier times the toolsmith and springmaker were the only specialists, while to-day 90 per cent. of the men are specialists, and only 10 per cent. are all-round mechanics. I am sorry to say that 9 per cent. of these are foreigners and not to the manner born.

In my opinion we have reached a point where it is almost impossible to get a first-class artisan—bear in mind the word artisan. We must admit from observation that the American system, insofar as the smith shop is concerned, is very different from that which prevails in Europe. We have neither the arbitrary features on one hand, of binding the smith apprentice, or on the other hand limiting the number of apprentices at the dictation of trades unions, as has been attempted in this country. The smithshop allows a man to develop instead of dwarfing individual liberty.

But to get back to the first class artisan, or all-round smith: How are we going to develop him? Possibly the technical school. . . . Do you think if I was possessed of a technical education that I should be contented to be foreman of a blacksmith shop? No, I should be looking for a better position. . . .

I do not agree with the Master Mechanics' committee regarding the course for blacksmith apprentices. They recommend the first six months on a bolt-heading machine; the next six months operating a steam hammer. If his term of apprenticeship is three years, one-third of his course gone, the boy had not acquired any knowledge of practical blacksmithing. Any intelligent boy can learn to head bolts in one week. From my own experience the first year should be spent in helping a blacksmith who is producing difficult light forgings. The smith should instruct the boy in the art, and when convenient let him use the hand hammer. Instruct him how to manipulate his fire for various shapes as may be required. Manipulating the fire, and knowledge of the heat required in different stages of producing forgings, is an important part of the art. The next six months helping on a light fire; the next six months manipulating a fire without a helper. If the above code is carried out the boy has worked two years; during that period he has worked six months at a fire, welding rings in chains, making split pins, etc. Now the young man has one year left in which to learn a trade that requires more skill and practice than any other branch of mechanics. The term for apprenticeship should be governed by the conditions of the class of work done in the shop. . . .

The discussion at the Master Mechanics' convention of 1898 is worthy of perusal by every master blacksmith. I think that Mr. Quail struck the keynote regarding the course of apprentices. He says: "All boys are not alike; I do not believe in holding one boy back because another boy is stupid; I think the boy should be pushed ahead as fast as he is capable of going."

TRACK TOOLS.

J. Coleman (C. & N. W.)—Track chisels give a great deal of trouble. I have seen five new chisels used up in cutting one rail. I would advise the railroad company to have their chisels made at some shop on their system. Chisels must be made of poor steel to sell for the price that I see quoted. Steel will work easier at a high heat and the piece worker is liable to get it a little too hot; but if the toolsmith is held responsible for the service given by the chisels made by him, when he gets a good quality of steel he will use good care in the working of the same. I made a few chisels from steel costing 12 cents a pound and hope to be able to report on the service given at the next convention.

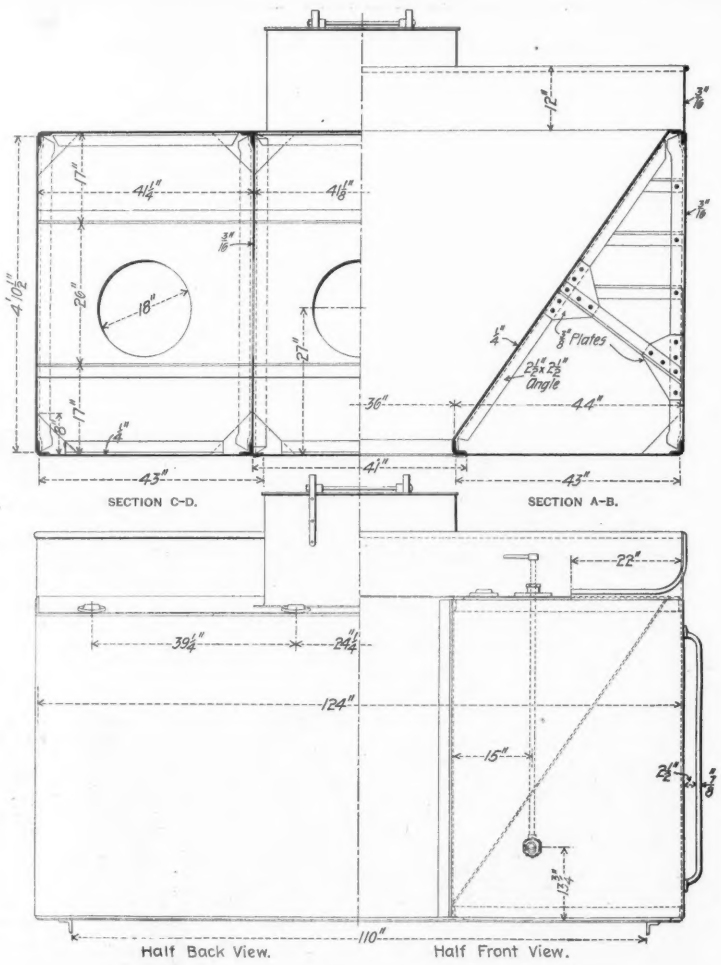
G. Lindsay (E. & T. H.)—Another recent tool is the scuffle or weedcutter. Some prefer it to the shovel for cutting weeds. The operator can stand almost straight while at work, and if the weeds are not too heavy they are a good tool. The shovel part we make from old shovels. We throw old worn out shovels in the furnace, straighten them under the hammer, shear to size, punch, sharpen, temper, rivet on, and they are better than new. In order to make it pay they have to be done in quantities.

Tender of 6,000 Gallons Capacity—Mexican Central Railway.

In order to meet the demand for increased water capacity, Mr. F. W. Johnstone, Superintendent Motive Power and Machinery of the Mexican Central Railway, has designed a tender which has a water capacity of 6,000 gals. and a coal capacity of 12 tons, and which, through his courtesy, we are enabled to illustrate. These tenders will be used with the 15 consolidation engines which the Brooks Locomotive Works are building for that road.

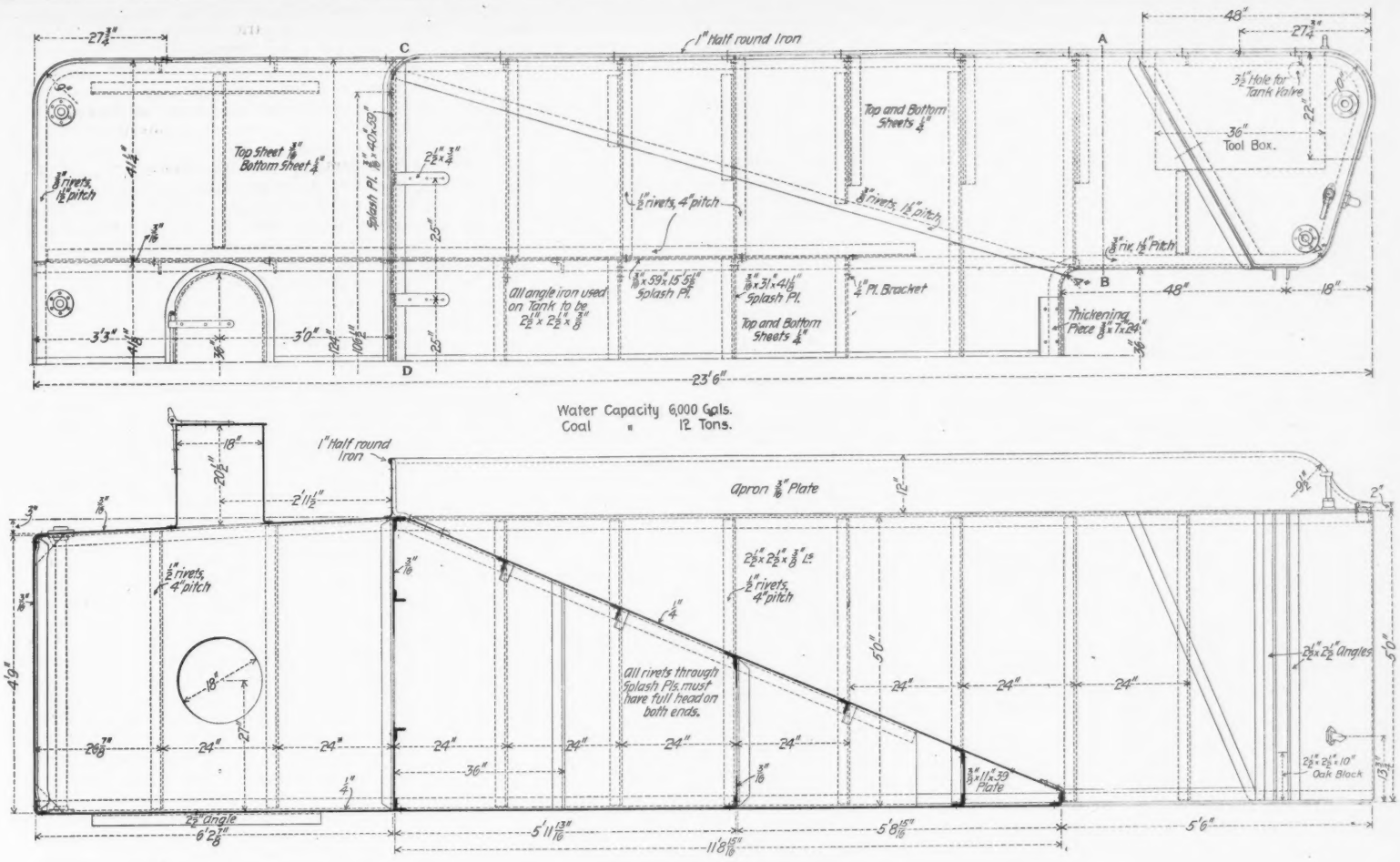
In the design of this tender, drawings of which are here given, it will be noticed that the old style of cross-bracing is entirely done away with, as the difficulty of keeping these cross braces tight has been thoroughly proved by experience. In spite of all precautions taken to put these braces in tight when building the tank, after some months service they will rattle loose, and do very little good. The sides of this new tank are braced by vertical angles, spaced 24 in. apart and lapping over the angles which form the joints at the top and bottom edges. The tank is further stiffened by the splash plates.

The bottom of the coal space is hopper-shaped so as to keep the coal within easy reach of the fireman, and has a 12-in. apron. This apron encloses only the coal space, the back of the tank where the manhole is situated being left open so as to prevent the accumulation of dirt, and permit its being easily cleaned off. The top at this point is given a slight incline to drain off the water which may be spilled on it. The bottom of the tank, and inside of coal space is made of ¼-in. steel plates, while the sides and back are of 5/16-in. plate.

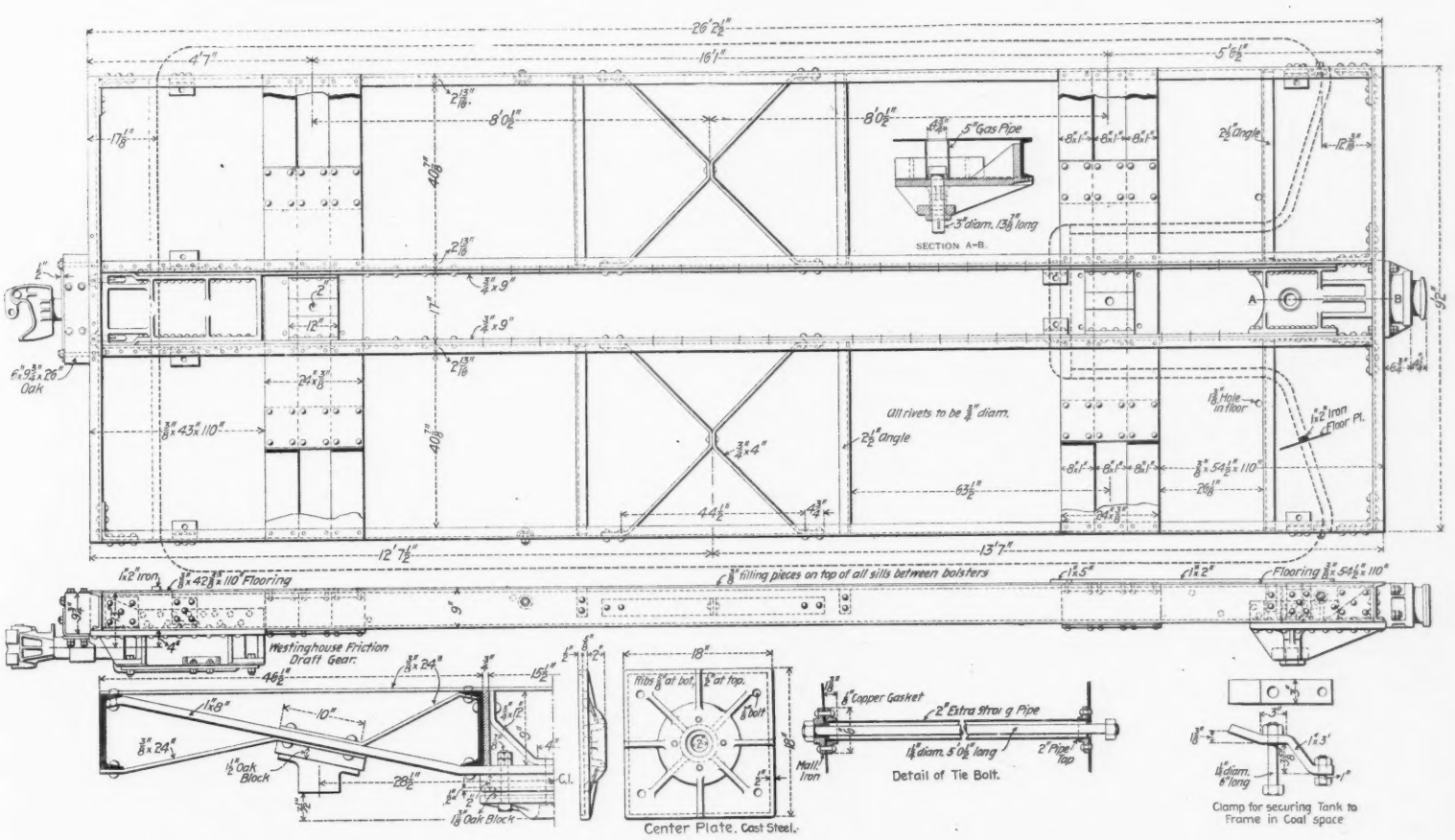


Elevations and Sections of Mexican Central Tender.

The tender frame is entirely of steel, the sills being 9-in. steel channels weighing 25 lbs. per ft. The center sills are reinforced by ¾ in. x 9 in. plates, extending almost the whole length between end sills. The joints at corners are made by ¾-in. x 7¼-in. knee irons. The design of the bolster is shown in the detail, the top plate being ⅜-in. x 24-in. steel resting on the top flanges of the sills and riveted to them with ¾-in. rivets. The bottom plate is in three pieces each 1 in. x 8 in., extending below the center sills and riveted to the top flanges of the side sills. Between the top and bottom plates are braces of ⅜-in. x 24-in. steel plates. Between the bolsters and the ends of the frame, both front and back, are ⅜-in. plates, extending full width of frame and riveted to top flanges of sills. These serve the double purpose of floor plates, and of holding the frame square. Heavy draft castings, front and back, are riveted between the center sills, while attached to the front end sill is a spring buffer to take up the motion between engine and tender. The center plates are cast steel and have holes cored through them so that by filling the truck center plate with oil, it will be forced up through these holes and be retained in the top center plate as in a kind of reservoir by which a better lubrication is maintained. One of the features of this tender is the method em-



6,000-Gallon Tank.



Frame and Details.

Standard Tender Truck of 1900.

Tender of 6,000 Gallons Capacity—Mexican Central Railway.

ployed to hold the tank on to the frame, and prevent its sliding when subjected to shocks. Behind the tank a 1-in. x 2-in. wrought iron bar, extending full width of tender frame, is riveted to the ⅜-in. floor plate, and in front there is a similar piece bent to conform to the outline of the tank. The tank is held down onto the frame by 1¼-in. tie bolts which extend from the frame up through the water space. As shown in the detail, malleable iron flanges, with copper gaskets, are riveted to the top and bottom plates of the tank, and a 2-in. extra strong wrought pipe is screwed into these flanges, thus forming a spacer for the plates—when the tie bolt is screwed down. There are four of these bolts at the back of the tank and four at the front. Two clamps of 1-in. x 3-in. wrought iron are also used at the center of the sloping coal space to further hold the tank in position. The object of these tie-bolts is to do away with the usual knee irons which are riveted to the sides of the tank and which become loose and cause leaks.

The trucks of this tender are also somewhat of a departure from the ordinary. They have the M. C. B. 5½-in. x 10-in. axles, and by the use of pedestals permit the placing of coil springs on top of the boxes, in addition to the regular springs under the bolster. The pedestals are cast-steel, the upper part of the pedestals forming the top spring seats for the springs above the boxes. The inside of the pedestal jaws have cast-iron wearing shoes, which can be easily replaced and prevent wear of the jaws. The transoms are 15-in. steel channels, with steel castings between them and the arch bars, both top and bottom. Cast-steel bolsters and bolster spring seats are used, the bolster springs being the triple elliptic type. The wheels have steel tires and cast-iron centers. The height of the side bearings can be adjusted by means of cast-iron cups fitting into pockets cast onto the bolster. These cups also serve as receptacles for oil and waste to lubricate the side bearings. The National Hollow brake-beams are used.

Record of Treated Ties—Atchison, Topeka & Santa Fe.

Mr. H. U. Mudge, General Manager of the Atchison, Topeka & Santa Fe, has sent us a record of treated pine ties, taken out of track during 1900, as shown by the accompanying table. This table explains itself quite clearly. It will be noted that 137,707 treated cross-ties were taken out for all causes and 2,103 treated bridge ties. Of these 2,677 cross ties and 434 bridge ties were

RECORD OF TREATED PINE TIES TAKEN OUT OF TRACK DURING THE YEAR 1900—ATCHISON, TOPEKA & SANTA FE RY.

Average Life and Comparisons With Previous Years.

Treated in Year.	Process	Rio Grande Division. Cross Ties. Rotten.	Rio Grande Division. Cross Ties. Other causes.	Rio Grande Division. Bridge Ties. Rotten.	Rio Grande Division. Bridge Ties. Other causes.	New Mexico Division. Cross Ties. Rotten.	New Mexico Division. Cross Ties. Other causes.	New Mexico Division. Bridge Ties. Rotten.	New Mexico Division. Bridge Ties. Other causes.	Western Division. Cross Ties. Rotten.	Western Division. Cross Ties. Other causes.	Colorado Division. Cross Ties. Rotten.	Colorado Division. Cross Ties. Other causes.	Middle Division. Cross Ties. Rotten.	Oklahoma Division Cross Ties. Rotten.	Oklahoma Division Bridge Ties. Rotten.	Oklahoma Division Bridge Ties. Other causes	Pan Handle Division Bridge Ties. Rotten.	Total. Cross Ties. Rotten.	Total. Cross Ties. Other causes.	Total. Bridge Ties. Rotten.	Total. Bridge Ties. Other causes.
1885	Wellhouse	1,631	....	...	...	6,805	6	....	...	....	4	4	...	...	..	..	..	..	8,440	10	....	...
1886	Wellhouse	2,367	40	...	...	7,531	9	....	...	120	...	...	...	...	..	..	..	..	10,018	49	....	...
1887	Wellhouse	3,748	187	...	...	16,572	48	....	...	158	...	...	...	...	..	..	..	..	20,478	235	....	...
1888	Wellhouse	5,436	324	50	...	13,370	137	17	...	52	...	...	...	...	..	..	..	..	18,858	461	67	...
1889	Wellhouse	1,611	2	...	...	8,690	181	....	...	406	...	18	...	...	..	..	..	..	10,725	183	....	...
1890	Wellhouse / Burnetising	1,485	....	...	...	8,616	169	....	...	97	1	3	...	...	..	..	..	..	10,201	170	....	...
1891	Burnetising	1,426	....	60	88	8,130	113	....	...	859	...	60	...	...	..	..	..	..	10,475	113	60	88
1892	Wellhouse. / Burnetising	1,881	....	...	...	16,456	142	48	35	441	37	100	26	...	..	..	..	..	18,938	205	48	35
1893	Wellhouse	1,263	49	317	...	9,115	56	84	57	410	...	200	4	158	1	..	..	..	11,147	109	401	57
1894	Wellhouse	123	42	12	78	2,630	80	148	...	449	118	263	152	...	..	..	..	..	3,465	392	160	78
1895	Wellhouse	22	....	12	...	783	3	30	48	65	6	42	6	...	..	..	..	..	912	15	42	48
1896	Wellhouse	41	2	8	...	92	1	76	...	18	67	6	175	...	5	..	..	..	162	245	84	...
1897	Wellhouse	46	1	...	...	71	....	....	...	....	...	...	...	...	..	..	6	..	5	117	1	11	...
1898	Wellhouse	8	1	...	...	....	....	....	...	2	...	...	55	...	1	..	..	..	11	56	....	...
1899	Wellhouse	1	....	...	...	....	....	....	...	....	...	...	20	...	..	..	92	..	1	20	....	92
1900	Wellhouse	....	....	...	...	....	....	....	...	....	...	...	...	...	..	..	..	..	....	....	....	...
Marks	Illegible	4,307	354	10	...	6,387	59	786	36	172	...	216	...	...	..	..	..	..	11,082	413	796	36
Total taken out		25,396	1,002	469	166	105,248	1,004	1,189	176	3,249	233	972	438	158	7	6	92	5	135,030	2,677	1,669	434

Chicago, Eastern & Southern Kansas Divisions report no treated ties taken out during the year.

*Average Yearly Service of Cross Ties.**

For 1900	12.04 years	11.20 years	9.02 years	7.87 years	7.50 years	Average of all divisions, 11.28 years.
For 1899	12.10 years	10.90 years	9.05 years	.....	.....	Average of all divisions, 11.11 years.
For 1898	11.15 years	11.05 years	8.57 years	.....	.....	Average of all divisions, 11.06 years.
For 1897, last nine months	10.88 years	10.69 years	8.43 years	.....	.....	Average of all divisions, 10.70 years.

*For this average, ties taken out and reported as "Marks Illegible." are included on percentage basis in totals of ties taken out in the years named below, and average life service figured accordingly: For 1900, included in years 1885 to 1892, inclusive; for 1899, included in years 1885 to 1892, inclusive; for 1898, included in years 1885 to 1891, inclusive, and for 1897, included in years 1885 to 1890, inclusive.

removed for causes other than decay. It will be noted, further, that the average life of these treated ties varies with the location and that the average life for all divisions of the Santa Fe has increased from 10.7 years, the life of the treated ties taken out in 1897, to 11.28 years, as shown by the records for 1900.

Wide Fire-boxes.

Pamphlet No. 27 of the Baldwin "Record of Recent Construction" is a paper read by Mr. Samuel M. Vauclain before the Pennsylvania Railroad Y. M. C. A. entitled "Broad Fire-box Locomotives." It is a brief running history well illustrated of the development of the wide fire-box. What follows is an abstract, very short and pretty freely paraphrased:

The Wootten boiler was brought out by Mr. John E. Wootten, Superintendent of Motive Power of the Philadelphia & Reading, about 1877, but the mechanical world is chiefly indebted to Mr. L. B. Paxson, Superintendent of Motive Power of the Philadelphia & Reading, for its great success and development. "Mr. Paxson's engineering skill, untiring energy and continuity of purpose beyond a doubt caused the success of the Wootten boiler for locomotives, the boiler that to-day is being modified in almost every conceivable shape and under fictitious names representing the principles on which the Wootten boiler was based."

While Mr. Paxson was developing the genuine Wootten boiler Mr. Alexander Mitchell, of the Lehigh Valley Railroad (the designer of the first Consolidation locomotive) was working along the same lines. Mr. Mitchell contended that the combustion chamber was unnecessary and undesirable, but Mr. Mitchell's design gave much more trouble than the combustion chamber, "due no doubt to the great amount of cold air which came through the shallow fire." The upshot was a return to the combustion chamber, much shortened, however. Mr. Samuel Higgins, Superintendent of Motive Power of the Lehigh Valley, brought out the boiler of this modified type containing 511 2-in. tubes and having over 4,000 ft. of heating surface.

Mr. Wootten gradually developed his ideas until he produced a wagon top boiler with stays actually radial to the crown sheet, and the dome on the extended portion of the wagon top. "It was this boiler, patented by Mr. Wootten, which prevented William L. Austin, of the Baldwin Locomotive Works, from obtaining letters patent on what is commonly called the radial-stay, extended wagon-top boiler, thousands of which are running and owe their existence to his inventive and engineering genius."

For anthracite coal no boiler has given such good results as are being daily obtained from the Wootten boiler. The result is a world-wide revolution in locomotive boiler design. "For several years the Baldwin Locomotive Works have guaranteed to build locomotives to burn successfully any fuel which may be sent to them, and in every case after a careful analysis some form of the Wootten boiler has been found necessary to enable them to successfully carry out their contracts."

Some Considerations on Electric Traction.

[*A letter to the London Times.*]

Mr. Balfour's terse statement, "The questions of overcrowding and congestion might be stated in terms of time and expense; there would be no congestion if every one could move quickly and at no expense to all parts of London." The admirable and concise illustrations in his speech at the opening of the West London Electric Tramways, and your editorial on the subject prompt me to make some observations which may appear pertinent. . . .

Mr. Balfour, in concluding his remarks, said "he felt he was dealing not with a merely local or commercial concern, but with interests far beyond the profits of shareholders—the interests of the vast population of London." He might have said with equal force that a wise solution of the London transportation problem would by its example have a national and even a world-wide effect. Most of the commerce of the world is carried on by people collected, and often crowded, into large cities or towns, and in all of these economy of time and decreased cost of living are as important as in London. Mr Balfour, therefore, might have added that any serious mistake made in London in the beginning might prove as inconvenient as English railway tunnels. . . .

The electric propulsion of vehicles, already well extended, admits of such radical departure from the old way as to suggest that we may, by discarding many of our old ideas and methods, have a veritable revolution in the prevailing practice. This point is illustrated by the fact that an electric railroad, upon which single cars are run at frequent intervals for a distance of about 45 miles, parallel to one of the standard railroads in the United States, is, after being two years in operation, carrying 20 times as many passengers as were formerly carried by the steam railroad between the same points.

It appears to be a logical deduction that railroads may contract for a supply of electric energy ready for use, quite as well as to purchase and install electric plants and thereafter to buy coal, supplies and labor for the production of electricity. Such being the case, it follows that the judicious selection of sites and the erection of the highest types of electric generating stations for the purpose should result in great saving in capital expenditure as well as in great economies in the subsequent cost of operation.

A General Power and Equipment Company.—It seems certain that the Metropolitan and Metropolitan District Railways must, for their own protection, proceed with all diligence to the electric conversion of their lines, and that therefore the present is an opportune moment for the establishing of a "mutual electric supply and equipment company" upon a basis which will give to those companies, and subsequently to all other railroads delivering traffic to the city over their lines the most advantageous arrangement possible; it being almost self-evident that if each of the companies operating in London were to erect power stations and to electrically equip its lines upon dissimilar, or even similar, plans, the capital expenditure would, for a given service, be fully double that required by a company having appropriate contract relations with the different railroad companies, and in which "mutual electric supply and equipment company" all such railroad companies should obviously be financially interested and represented.

Such mutual supply company with appropriate powers could, in the first instance, contract with either or both the underground companies to furnish a complete electric plant, including new cars and the electric line and equipment, and to maintain and operate the power plant, sub-stations, electric feeder systems, and to deliver current to the collector rail for a long term of years; to supply all current needed for other power purposes, such as for the operation of moving stairs or lifts, lighting of stations, tunnels, etc., at a low rate per Board of Trade unit; to supply current for train power and lighting service of connecting or other railroads, and to maintain a qualified corps of engineers and inspectors to assist in the inspection and maintenance of the electrical equipment; the railroad companies permit the use of their real estate for the location of stations or sub-stations; to secure or co-operate in securing all necessary Parliamentary powers for the establishing of power plants on such real estate and for enabling the companies, if thought best, to maintain but one class of accommodation for passengers and with the right to establish a uniform rate or rates for distances within certain limits; to pay the contracting company, as a rental for the apparatus and car equipments furnished and for the current supplied, at a rate per passenger carried, the railroad companies maintaining the car equipments and tracks, and to operate efficiently all departments of their service.

Such contracts between a mutual electric supply and equipment company and the underground railroads and those subsequently made with other companies would provide for an adequate supply of electric energy for all of the parties to the arrangement and for any additional car equipment which might be required, to accommodate the larger traffic resulting from the substitution

of the electric motor for the locomotive, and would thus bring the capital expenditures of the various companies to less than half of what they would be if each company were to establish its own plant and purchase its own new car equipments.

In the struggle for very slight economies in the production of electric current, the ambitious electrical engineer has conceived that the best way to establish electric traction is by means of the erection of one enormous station from which high tension alternating currents may be transmitted to various points and there converted into continuous currents for local use. The electrical engineer has been encouraged and aided by the manufacturer, because this type of station has involved the use of the greatest amount of electrical apparatus. This plan necessarily involves tearing up roadways for laying cables required for carrying energy, and causes other inconveniences and risks. It is a fact that scarcely one of the great electric power stations heretofore built and operated is satisfactory in respect of cost of operation and other particulars to the owners of such plants.

The advantage of the current being generated by a mutual supply company cannot be overestimated, because a *minimum* amount of apparatus would be used and the stations employed would be so distributed as to reduce to a minimum the inconvenience resulting to the public from the installation of such great undertakings.

The foregoing suggestions involve the use of railway carriages similar to those employed upon the Central London, arranged in trains of three carriages each, two of such carriages being fitted with motors and controlling apparatus, the third being interposed. These carriages to be equipped with "unit control" and brake apparatus, and with coupling devices which will automatically unite them and the brake connections and the "unit control" electric connections at the same instant, without an appreciable loss of time. This provides for the joining together of two or more trains and the convenient operation of the entire equipment by a single motorman at the front end of the train.

Gas Engine Power Stations.—Of great importance to those who invest capital in these undertakings are the facts with reference to the cheaper generation of electric energy—which means the cost of power—since the first outlay for a plant is of far less importance than the continued cost of operation. . . . The saving to be effected by the use of large gas engines supplied by producer gas . . . will equal an amount which will represent an interest on about twice the estimated cost of a given power station of the modern type. The far-reaching effect of the cheap production of electricity can only be appreciated by going most carefully into the subject. Suffice it to say, however, that it is only by means of a much cheaper method of generating electricity than b the use of steam engines of even the best type, that one can hope to effect such economies as will justify the great railroads in operating all of their suburban trains by electricity.

Roughly stated, the expense for fuel and labor for the production of electricity by a gas engine equipment will not be greatly above one-third of that of the highest type of steam plant, while, in comparison with the average steam plant, the fuel consumption and cost will not exceed one-quarter. The decreased cost of production of electricity by means of gas engines, as compared with the present steam engine plants, would enable a Board of Trade unit to be sold at so low a figure as to justify a wide use of the electric current for cooking and heating purposes.

In discussing the importance of the cheaper generation of electricity by means of gas engines and producer gas, one is met by much scepticism and frequently by the arguments of people having contrary interests. A sufficient answer to the sceptic and the interested party is the fact that apparatus will be supplied and results guaranteed. Representatives of large interests, ignoring what has heretofore taken place, have observed that to put in a large gas engine plant would be a great experiment; but on this point one may reply that it would be a much greater experiment to now establish a modern steam engine alternating generating plant, and in view of what can be accomplished with such economies with the gas engine, a far greater risk.

GEORGE WESTINGHOUSE.

London, July 13.

Locomotives in Japan.

We have received a copy of the Japan *Daily Advertiser* of Aug. 8, containing an article on American and English Locomotives in Japan, printed from the Kobe *Herald*. A few extracts follow:

"We are able through the courtesy of the Sanyo Railway officials to give the results of the experience of this, the principal local company—one of the most enterprising rail way corporations in Japan. In brief, it may be stated at once that the testimony of the Sanyo Company's officials is wholly against the British locomotive.

"The Sanyo Company has been using American engines for six years. They had before used British engines only, and so favorable is the opinion formed of the American engine as against the British that the company does not at present contemplate ordering any more British locomotives. On the other hand, the company ordered eight locomotives from the well-known American works at Schenectady, New York State, as recently as May of this year, and they have at present ten engines on order from the Baldwin Works of Philadelphia. The Sanyo Company has altogether 33 American locomotives at work, exclusive of those about to arrive and those recently ordered. The company has 24 English engines. The officials do not intend to order any more English engines just now. 'Our principal reasons are that we cannot get them quickly enough, and that they cost one and a half times more than the American engine.'

"The Sanyo Company finds 'we can run American and English engines upon nearly the same consumption of coal. And the American engines work as well as the English engines. The coal consumption of our American locomotives used to be great in comparison because we only began to import them years after we had the English engine, and their working was therefore new to us. Now, however, we find that the consumption of fuel is about the same with American and English engines.'

"On the question of the relative durability of the two locomotives, the Sanyo representatives say they believe that the 'life' of the American locomotive will be shorter than that of the English engine, but they had not actually found that this was so as yet—simply because their experience was not extensive enough so far. The workmanship of the American engine, it was stated, is rough, very rough, sometimes, while that of the English engine is good, very good in fact. The boiler in American engines is found more liable to leak than the English boiler, which is very tight and well-fitted. In American engines the construction has been found to be more scientific and original. The English engines showed inferiority of design, but the workmanship is very good. In fact, the old observation recurred even here, the English manufacturer is conservative if thorough, much more conservative than the American, who, however, is less thorough."

Train Movements at Reading Terminal.

The terminal of the Philadelphia & Reading at 12th and Market streets, Philadelphia, is probably one of the busiest stations, of its size, to be found anywhere. It has not a large number of tracks in the shed, and these are not very long; and the approach is by only two main tracks; but the total number of scheduled trains (on week days 212 in and 215 out) is large, and the frequency of trains in the congested hours taxes the capacity of the tracks for two hours or more. Probably the most instructive test of the capacity of a passenger yard is to compare the regular time-table with the length of time that it takes to recover from a slight delay; and we are informed that at this station a blockade of 15 minutes on one track at 5 o'clock in the afternoon causes some delay to nearly all of the trains until about 8 or 8:30. Passengers (and sometimes railroad officers) usually attribute this three or four hours of irregularity to the inefficiency of the men; but as the same result is observable at all large passenger terminals when an obstruction occurs, and happens at times when both the personnel and the appliances are in normal condition, we must conclude that such delays are the inevitable result of the cause named; that if a superintendent were to bind himself to resume normal running within, say, one hour, after clearing an obstructed track, he would have to reduce the number of his regular trains considerably below the number that can be handled safely and conveniently when everything runs smoothly. This reasoning is borne out by experience at all the busiest terminals.

We mention the Reading Terminal at this time, however, not to emphasize its irregularities, but to give an example of what it can do. Supt. Charles A. Beach, of the Philadelphia division, has shown us the record of the train movements between the terminal and Wayne Junction, 5.1 miles, for the month of June last, from which it appears that with a total movement of 13,503 trains the number delayed was 1,251, equal to 9.26 per cent.; and the total amount of time lost was 3,355 minutes, an average of about 2.7 minutes' delay to each of the 1,251 trains. Of the outbound trains 79 per cent. passed Wayne Junction (or cleared the terminal division) on time; and of the inbound trains 88 per cent. reached the terminal on time.

The causes of the delays are tabulated as follows:

Reading Terminal June, 1901.

Number of trains carrying passengers	12,194
Number of trains empty to and from cleaning yard	1,309
Total	13,503
Number of trains delayed as shown below	1,251

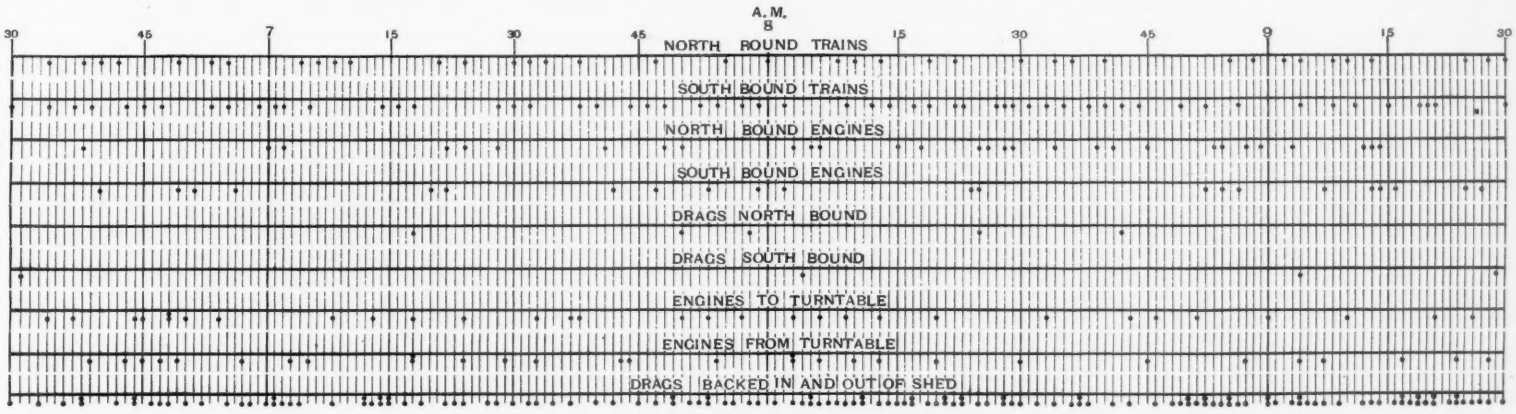
Causes of Delay.

	Trains.	Minutes.
Connections—Wayne Junction	65	392
" Columbia Avenue	3	5
" Other stations	13	31
Station work—Baggage, mail and express and leaving and taking cars	130	224
Cut out*—Columbia Avenue	35	40
" Tioga	23	23
" Wayne Junction	90	171
" 16th Street	6	7
" Other stations	9	11
Trains ahead	596	1,608
Light engines and drags ahead	40	94
Reduced speed at Nicetown for new work	97	112
Engine failures	25	81
Car trouble	12	47
Interlocking and automatic signal failures	14	57
Air failures	4	13
Signals at terminal	42	107
Derailments	30	255
Other causes	17	77
Totals	1,251	3,355

79 per cent. of all outbound trains cleared division on time.
80 per cent. of all inbound trains reached junction points on time.
88 per cent. of all inbound trains reached Reading terminal on time.

Comparison.

	March.	April.	May.	June.
Number of trains delayed	1,048	732	1,032	1,251
Total minutes delayed	3,128	1,432	2,560	3,355
Average minutes delayed	3.0	2.0	2.4	2.7
Outbound trains cleared division on time, per cent	84	87	85	79
Inbound trains reached junction points on time, per cent	..	80	81	80
Trains arrived Reading terminal on time, per cent	90	94	88	88



Record of Train and Engine Movements at Reading Terminal, Philadelphia, July 12, 1901; 6:30 to 9:30 a. m.

As before stated, the total number of trains running to and from this station is about 427 daily. But, of course, a large percentage of this movement is concentrated in the morning and evening hours. To illustrate the congestion at these times we show in the accompanying diagram the actual movement each minute for three hours on the morning of July 12 last. This diagram is copied from a portion of one prepared by Mr. Beach showing the ordinary normal movement each week day (though this shows the actual movement on a given day). In the following table the first column of figures shows the ordinary movement for a day of 24 hours. The second column shows the movement for the three hours above mentioned, the respective items indicating the total number of dots on the corresponding line of the diagram.

Number of Train and Engine Movements.

	24 hrs.	3 hrs.
North-bound trains	216	39
South-bound trains	213	57
North-bound engines	285	30
South-bound engines	183	22
Drags, north-bound	22	5
Drags, south-bound	27	4
Engines to turn-table	106	31
Engines from turn-table	108	30
Drags backed in and out shed	660	139
Totals	1,820	357

The Engineer School of Application.

The War Department has ordered that the Engineer School of Application and the battalion of engineers at Willett's Point, N. Y., be transferred to the Washington Barracks, at Washington, D. C. Graduates of the Military Academy who are assigned to the Corps of Engineers receive a three years' post-graduate course of instruction in military engineering at this school, and its transfer to Washington is thought to be preliminary to the establishment of the proposed Army War College.

* Waiting for passenger trains on other track moving in opposite direction.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

The gross earnings of the railroads for the half year ending June 30 amounted to 749 million dollars, this being for 181,337 miles. The figures are compiled by the *Chronicle* and were published in that journal last week. The gain over the first half of 1900 was practically 10 per cent., or $67,647,000, but the reports last year were from 4,300 miles less of road. These gains in gross have been continuous since 1894, when a loss of 16.6 per cent. was recorded. In 1895 the increase was 3.2 per cent., in 1898 it was 12 per cent., and in 1900 it was 13.5 per cent. It will be seen that the continued gain this year has a special significance coming after the important gain last year. Among individual roads the Southern Pacific leads in increase in gross earnings closely followed by the Pennsylvania East of Pittsburgh and Erie, the Reading and the Atchison. The Lehigh Valley gained 3 1-3 millions, and the Illinois Central, Missouri Pacific, Baltimore & Ohio, Missouri, Kansas & Texas, Union Pacific, Erie and Northern Pacific each gained in amounts ranging down from 2 1-5 to 1¾ millions. The Burlington, the Rock Island, the Texas & Pacific, the Louisville & Nashville, the Southern and the St. Louis & San Francisco each gained over a million.

The engineer who went out to Burmah to erect for the Pennsylvania Steel Company the celebrated Gokteik bridge has published a popular account of that experience in the *World's Work* for September. We shall print some extracts from this, but here we wish to call attention to a few of his sentences which have little to do with engineering. "Going up to Maymyo (only ten years ago a hornet's nest of dacoits, but now a thriving village half European and half Burmese, soon to be the headquarters of the Army of British Burmah) we criss-crossed, etc." And again "on the plain itself and indeed throughout the Shan States, though it has belonged to the Indian Empire for only fifteen years, the country has already been reduced to systematic order. The former soldiers of Thibaw, the last of the Burmese kings, are now building better roads than I have ever seen in my native state in New England, and the reform dacoit, as he cultivates his rice field and patches up his irrigation ditches, can see the steam road roller lumbering through the jungle that he shared not long ago with elephants and tigers. The whole province, about as large as France, is the most prosperous in India." No doubt many of the young Americans who are now going abroad to govern brown men and black men will read these words. Probably not more than 5 per cent. of them will read the words twice or think particularly about them, and yet they are by all odds the most important and significant words in Mr. Turk's article. They give us a little glimpse of the colossal work that the British have done and are doing in civilizing the earth; and they suggest to the thinking man something of the way that work is done. The State Department and the War Department ought to put into the hands of our young colonial administrators, civil and military, books that will tell them of the lives and deeds of the Lawrences, Edwardes, Outram, Rajah Brooke and Gordon. Captain Mahan once said to us, "Men like these are in themselves the justification of the Indian Empire."

On another page will be found an article describing in a good deal of detail the improvements that have been made in the last two or three months in the car motors of the Compressed Air Company, several machines of the new design being now in service. It will be observed that these improvements do not change the principles upon which the older motors were designed; they are only changes in mechanical details. But we all know from more or less hard experience that it is precisely the steady advance of mechanical details towards perfection that makes success. In these later motors dimensions have been increased; the valve motion has been strengthened and simplified; the valve itself has been improved; additional storage has been provided, and a very important change has been made in the design of the re-heater. Here, again, the principle remains precisely as before. The changes made facilitate inspection and do away with the possibility of the air pipe getting adrift inside the heater, as has happened. From the sum of these changes we expect much better performance, not only in economy of air but in economy of maintenance, than has ever yet been reached by compressed air motors either in France or America, and the new motors which have been run for a few weeks on the Rome City Railway justify this expectation, so far as experience with them has gone. Every transportation man of much observation or experience has in mind some field where an independent, self-contained motor is called for. Of course the great field is in large towns where the overhead trolley is prohibited and where the underground conduit construction is too costly. Indeed the conduit may always be assumed to be too costly except in a few places of the greatest traffic. But beyond the field existing in large towns, there is that of suburban traffic, where it is often desired to increase the frequency of service by interpolating units of one or two cars between the heavier trains hauled by locomotives. This kind of service is particularly desirable in the hours of comparatively light traffic. Still further, there is an obvious field for a motor of this sort on branches, and on sections of light traffic, where business could be quickly developed by a frequent service. A few years ago a good many of us hoped that the steam motor car might fill the gap, so far as existing steam railroads go, but that has now failed and it is left to the Compressed Air Company to occupy this field.

Concerning Common Civility.

Passengers, or would-be passengers for New York from Albany on Monday by the Hudson River Railroad who sought to take the 2:35 p. m. train were informed that no express train would leave for the south before 5 o'clock. To all inquiries as to the cause of this delay of nearly three hours the only response was a statement that the trains from the West were behind time. The new station at Albany is a cheerful place compared with the sheds that formerly existed there, but its resources in the way of comfort and pastime for weary men, women and children are neither varied nor extensive, and chewing the cud of reflection as to lost connections or engagements made impossible of fulfillment does not lessen the tedium of waiting. It is one of the perverse tendencies of the human mind to derive a certain consolation for misfortune from a fairly full understanding of its cause, and in a case of this sort it would have been a real assuagement to have the details of the matter to think of or to discuss. A corporation is apparently ignorant of this tendency or indifferent to it, and leaves its victims, so to speak, to stew in the fat of their own helplessness. The New York Central & Hudson River Railroad Company is no worse than many another in this regard. But why should any of the transportation companies be as bad as they are? The facts that are of any importance are sure to be made public sooner or later. Why not give patrons the satisfaction of knowing them promptly? It could easily be done, for the companies have ample use of the telegraph and all the means of spreading information. It would soften the asperities of travel and foster good will among travelers. And good will is an asset.—*New York Times.*

The editor of the *Times* very justly says that "good will is an asset." No one will dispute this proposition. We have occasionally in midsummer editorials put something of the same notion in somewhat different words, as, for instance, "civility has direct earning power." Probably this will not be disputed either. But further, it is not an unfair reading of some of the phrases quoted above to say that the editor intimates quite plainly that the transportation companies are peculiarly lacking in common civility. Here is room for difference of opinion.

Incivility is not uncommon among the servants of the transportation companies, but they have no monopoly of it. It has happened to the writer of these lines three times within the last 18 months to call at the offices of two of the great daily newspapers in New York, twice at a business office and once at an editorial office. On neither occasion did it seem worth while to trouble the editor or the business manager, and on each occasion the visitor was received with an underbred insolence which he has never seen excelled at the ticket window of a transportation company. The same sort of incivility in greater or less degree is notorious in the shop of a well-known dealer in Oriental wares in New York and at certain counters of some of the great department stores and in an important cheap book store in New York—now naturally in financial difficulties. Every man, and woman too, can parallel these experiences without going to the office of a transportation company.

But without inquiring further into the relative incivility among the lesser employees of transportation companies it may be interesting to look a little into its sources and its effects.

It is a pretty safe generalization that the manners of that part of the staff which must deal with the public reflect in a measure the manners and spirit of the higher officers. This is a broad and sweeping generalization. Sometimes there are conditions which make it very difficult for the chiefs of departments to influence greatly the manners of the mass of those of their subordinates who must meet the public. This is especially true, for instance, of transportation lines in great cities. There, in the nature of things, will be found a considerable percentage of employees who take service only to tide themselves over an interval and who do not intend to stay permanently. Such men are difficult to teach or to discipline and they are not long enough in the service to be really affected by the spirit of their superiors. There also the employees are constantly in contact with an exacting, unreasonable and badmannered public. This is no excuse for their own manners, but it helps to explain the difficulties of training up masters of deportment in such service. But these conditions do not obtain on the great steam railroads such as the *New York Times* editor speaks of, and consequently, discriminating men will naturally judge of the manners of the officers of those roads by the manners of the men in the stations and on the trains. In the same way one will, whether justly or unjustly, judge of the manners of the editors and business managers of the daily newspapers by the manners of the young men whom he meets in the counting room or in the outer offices of the editorial rooms, and even in some degree by the manners of the hoodlums who drive the newspaper delivery carts, than whom there is probably no more offensive class in any of the great cities.

We have laid down the propositions that civility pays; that incivility is not peculiar to the transportation companies, and that good breeding and a courteous spirit in the general offices will trickle down through the whole line even to the usher who bellows in the gates. But, to be more specific, let us look a little for the cause of that particular kind of disregard of the rights and feelings of patrons of which the *Times'* writer complains. It is largely the survival of a stupid old superstition that, for policy, affairs along the line must be kept quiet. A similar superstition lingers with great obstinacy in newspaper offices, that a mistake must not be admitted; that a correction, if made at all, must be made with such qualifications as will save the editor's face; or, when that is impossible it must be inconspicuous. Obviously, these superstitions will disappear with the spread of enlightenment. Candor is also an asset; mystery and pomposity are part of the middle-age properties with which the game used to be successfully played, but with the spread of intelligence they have lost their force.

It is proper and wise to keep from the public knowledge of some things that happen on a railroad. This goes without saying, and it is likewise true of other occupations. In a machine as big as a railroad one immediately runs against the difficulty that employees cannot be allowed large discretion as to what may be told and what may not. Consequently, as organizations have grown, so has the practice grown of forbidding subordinates to give information beyond the strict line of their duty. The result is not agreeable or conciliating. Probably it would be much better to instruct officers and clerks to give information freely and take the chances of their telling too much. Probably an intelligent public would take a

reasonable and even a liberal view of troubles that it understood, and, in spite of appearances to the contrary, the American public is really intelligent, and it is notoriously good natured.

Annual Reports.

New York, Ontario & Western.—The annual report of this company for the June 30 fiscal year shows that gross earnings for the first time in its history exceeded $5,000,000. The exact amount was $5,322,884, an increase of $359,400, or 7¼ per cent. over the 1900 figures. This again was mostly due to increase in coal tonnage and revenues, a fact of interest in view of the decreased tonnage of other coal carrying roads for the same period, through the suspension of anthracite coal mining last September and October, on account of the miners' strike. The coal revenues of the Ontario & Western last year for the first time rose above 50 per cent. of the total gross receipts of the company. They represent a traffic movement which has been virtually created during the last decade, the revenue from which now exceeds the gross earnings reported in 1890, when the Scranton line, on which the coal tonnage originates, was opened. The condition of the hard coal trade, therefore, has become of primary importance to the company and the discussion of that business and the means of handling it take up the largest share of the present report.

Last year's results are also marked by large passenger revenue, chiefly through the growth of local business, and the general manager notes the interesting fact that these earnings have steadily increased since fares were reduced from three cents to two cents per mile in 1898 by a State law.

Details of the income account follow:

Receipts.	1901.	1900.	1899.
From passengers	$855,201	$787,899	$709,266
From coal	2,546,918	2,223,464	1,923,503
All freight	4,345,997	4,057,961	3,525,819
Total receipts	$5,322,883	$4,963,482	$4,346,163
Expenses:			
Maintenance of way	$759,914	$637,747	$511,532
Maintenance of equipment	686,724	682,761	513,578
Conduc. Trans.	2,046,278	1,823,741	1,677,703
General expen.	145,423	135,378	133,047
Taxes	138,796	135,288	134,248
Total operating expen.	$3,777,136	$3,414,916	$2,970,110
Net earnings	1,545,746	1,548,565	1,376,052
Interest, rentals and taxes	666,514	689,541	689,688
Surplus	$879.231	$859,024	$686,364

This surplus, if used for dividend payments would have to be spread over $58,114,000 outstanding stock. President Fowler points out that all the surplus heretofore has been appropriated in the development of the property, and urges the need of further strengthening the line, adding to equipment and loans to coal companies to retain their tonnage to the railroad.

Much was done in the past year in improvements, and in new facilities for handling coal and other traffic, the benefits from which are expected to be more apparent in the present year than in the year just closed. Thus, eleven new consolidation engines have been put in service, but on account of delay in strengthening bridges, these had only limted service. On the Scranton Division, where four of the engines were in service for a year, they increased the train loads to 28½ cars and 350 tons. These figures ompare with averages for the road in 1901 of 290 tons per train and 23.7 cars per train, these figures not being materially changed from 1900 results.

Interesting tables show weight of engnes for a series of years and the increase in tractive power and drawbar pull. In 1890 the average tractive power per engine was 23,500 lbs., and it is now 26,344 lbs. The minimum weight of engine, now 37 tons, was the maximum in 1881. Sixty ton engines were not used until 1900, when the first 100-ton engine was bought, and there are now eleven of these latter in service.

Improvements carried out during the year called for the expenditure of $328,746, of which $140,616 was charged to capital account and $188,130 to expenses. The largest appropriation was $116,676 for a coal storage plant at Middletown. Work was begun in June on a new coal dock at Weehawken, which will involve a large expenditure this year. In addition to this work, the company contracted for new equipment costing $675,000, including 575 wooden coal cars and 50 steel cars. Of the contract price $570,000 is carried on car trust notes, payable in five years.

Capital accounts show important changes through the purchase of coal lands, this policy having been generally followed last year by the anthracite coal carrying lines, resulting in the elimination of the individual operator. Through this policy "investments in other companies," as carried in the company's balance sheet, have been increased from $7,406,600 in 1899 to $13,096,600 in 1901, while $5,875,000 of notes have been issued by the railroad on account of the coal land purchases, secured by mortgages on the mine properties, which so far have met the interest on the bonds issued on their account, and made substantial payments on the principal of the mortgages.

Southern Railway.—The expansion of this company in mileage, which has been important each year since the reorganization of 1894, continued in the fiscal year, ending June 30, for which the report was issued recently. The additions, if the Mobile & Ohio is included, were larger than in any previous year. The company secured two routes to St. Louis, one north of the Ohio River and the other through the Mobile & Ohio, which also gives it a connection with the Gulf. In addition, it protected its connection with Savannah by purchase and building, so that it was able to surrender 65 miles of trackage, and strengthen its position in view of the Seaboard's new through line to that point. The net addition to operated mileage was 298 miles, exclusive of the Mobile & Ohio Railroad, which is to be operated separately. The Southern Railway now includes 6,729 miles, as against 6,431 miles on July 1, a year ago. The company operated an average of 6,612 miles last year, against 6,306 miles in 1900.

Two income accounts are presented in the report to show the year's results, and the changes from 1900. The table of actual results of income covered into the treasury, irrespective of the dates when the new lines were taken over for operation, shows gross earnings of $34,660,482, a surplus over fixed charges of $3,540,500, and a balance over the 4 per cent. dividends on the preferred stock (an increase of 1 per cent. over the 1900 dividends) of $1,140,500. A comparative statement of income, excluding the new St. Louis division, and for substantially the same properties in the two years, shows a gain of $2,220,000, or 7 per cent. in gross revenues; of $1,505,900, or 6⅞ per cent. in expenses and taxes and $713,649 in net earnings. Proportion of expenses to taxes was 69⅞ per cent. in 1901, as against 70 per cent. in 1900. The balance of surplus income in 1901 over charges, was equal to nearly 6 per cent. on the $60,000,000 of preferred shares now outstanding, as against 4⅞ per cent. in 1900. The growth of the annual surplus in recent years will indicate how rapidly the net earning capacity of the property has been developed, and the figures follow:

1901	$3,520,500	1898	$1,007,012
1900	2,917,252	1897	445,920
1899	2,094,520	1896	556,479

Of the gain in gross earnings, reported for 1901, freight receipts yielded $1,923,000 and passenger receipts $1,081,000, the growth of this latter revenue being a marked feature in the annual statements now coming to hand. The gain from this traffic was due entirely to larger passenger movement, the average passenger-mile rate showing a loss from 1900, it being now 2,326 mills. The increase in passenger-miles was 40,000,000, or over 12 per cent., the increase in revenue being 10¾ per cent.

On the other hand, better average rates helped out the company's freight earnings, rather than any great growth in tonnage. The expansion in ton-mileage was only 2 per cent., the average train haul having fallen from 168 miles to 166 miles. Ton-mile rates increased from 9.17 mills to 9.47 mills, but this appears to have been largely due to the higher proportion of merchandise, manufactures and other higher class freights carried last year. But 5 per cent. of Southern Railway's traffic is from cotton, and but 14 per cent. from all agricultural products, while 29 per cent. of the tonnage is classified as manufactures and miscellaneous.

This larger tonnage was handled at less cost than the smaller movement of the previous year. There was a decrease of 6⅛ per cent. in freight-train mileage from 13,057,500 to 12,229,500; freight car mileage was about the same in the two years, and with more cars in each train, and better lading, the company was able to secure an increase in its average revenue trainload of 15 tons. With these results and the higher ton-mile rates, earnings per freight-train mile rose to $1.81 from $1.62 in 1900, an increase of 12⅛ per cent. The record of this part of the company's progress is told in a table, giving statistics back to 1895.

THE SOUTHERN RAILWAY FOR SEVEN YEARS.

	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Miles worked	4,139	4,573	4,805	4,827	5,254	6,306	6,424
Freight train miles	7,483,843	8,553,217	8,941,793	9,627,681	10,969,005	12,989,996	12,229,526
Revenue tons	6,675,750	7,941,980	7,904,706	8,554,012	10,220,200	13,590,353	14,121,181
Tons, all freight	.....	8,701,210	9,106,543	9,948,707	11,707,677	15,492,024	16,245,876
Revenue ton miles	*1,098,983	1,239,686	1,324,015	1,436,674	1,771,925	2,294,258	2,344,053
All ton miles	.....	1,389,993	1,545,274	1,690,085	2,057,572	2,641,271	2,732,279
Revenue train load	146.8	144.4	148	149.2	161.5	176.6	191.6
Total train load	.....	161.9	172.8	175.5	187.5	203.3	223.4
Receipts per ton mile, cents	0.984	0.972	0.936	0.933	0.897	0.916	0.947
Earnings per freight train mile	$1.445	$1.405	$1.385	$1.392	$1.451	$1.617	$1.816

*000 omitted.

NOTE.—The above statement gives for each year only the results of operations by the *Southern Railway Company* in that year.

Improvement of roadway and equipment has helped to bring about these results. "During the fiscal year the ruling grades and curvature on the entire line between Knoxville, Tenn., and Asheville, N. C., 129 miles, have been so reduced that the trainload has been increased from 850 tons to 1,200 tons, or 41.18 per cent. The cost, $269,708.36, has been charged against income. Similar improvements have been begun on the line between Asheville and Salisbury, N. C. When this work shall have been completed, a year hence, a standard freight engine will be able to haul a uniform train of 1,200 tons from Knoxville, Tenn., to Pinners Point (Norfolk, Va.), 584 miles, except over the one grade at the mountain summit east of Asheville. Contracts have been awarded for reduction of grades on the St. Louis Division between East St. Louis, Ill., and Princeton, Ind., 158 miles, to a maximum of 42 ft., but with a maximum of 26 ft. westbound from the Illinois coal fields into East St. Louis. The estimated cost of the work is $320,000. This improvement will increase hauling capacity of the present locomotives on the entire 158 miles about 30 per cent."

Most of this work is being carried out without issuing capital obligations. Total charges to capital last year were $1,133,000, of which $617,983 was for additional equipment. As against this $1,425,000 was charged against operating expenses in the year to represent the cost of 25 locomotives, 15 passenger cars and 1,223 freight cars. President Spencer is able to say: "Expenditures for new equipment charged to operating expenses or to reserves for maintenance reflect the company's policy of gradually improving the condition, capacity and efficiency of its rolling stock without increasing correspondingly its capital account. The replacement of all equipment retired since the company commenced operations in 1894 has been fully provided for by charges to operating expenses," and he could very properly have added that much more than this has been done. Maintenance cost, last year, in fact, accounts for $979,000 (or two-thirds) of the increase in expenses, as, indeed, it has in each year of the present company's history. There was laid during the year 32,109 tons, or 255 miles, of new rail, as compared with 219 miles in 1900. About 160 miles were newly ballasted, and the total ballasted track on June 30, 1901, was 2,787 miles, or about 44 per cent. of the total mileage. Of the cost of renewal of bridges, the sum of $268,035.12 was expended for new steel bridges to replace wooden or other inferior structures.

Mr. Spencer has a paragraph on the strike of the shop machinists, pointing out that "many of the demands were unreasonable in themselves and could not have been acceded to, but aside from this consideration they were in the form of an ultimatum, in writing, with the frank avowal that they must be granted as a whole, or a strike would ensue. The subject matter was discussed by the company's officers, with explanations that arbitrary rules laid down by others could not be adopted in the management of the company's affairs," and another conference was offered, but the men struck. All are still out of the company's service, with 85 per cent. of their places filled.

The Carnegie Technical University.

The proposed Carnegie Technical University is making progress. Those who have followed the several announcements that have been made will remember that the preliminary work incident to its organization was entrusted to a local board, the members of which are already the Trustees of the Carnegie Institute and of the Carnegie Library at Pittsburgh. Under the direction of this local board there was constituted some months ago a committee of expert advisers to consider and report upon the plan and scope of the work to be organized. This expert committee was made up of Dr. R. H. Thurston, Director of Sibley College, Cornell University; Prof. J. B. Johnson, Dean of the College of Engineering, University of Wisconsin; Prof. Thomas Gray, of the Rose Polytechnic School; and Prof. V. C. Alderson, of the Armour Institute. It was understood that the conclusions of these gentlemen would not in any way commit Mr. Carnegie to the line of action they might propose, but rather that their report would stand merely as a recommendation to the local committee. The expert report has just been published. While, for reasons stated, it does not settle anything, the prominence of the individual members of the committee and the expected magnitude of the enterprise for which they were asked to plan, serve to make it an important document.

The scheme which the experts have outlined divides the proposed work into three general divisions, namely: (1) the Carnegie Technical College, (2) the Carnegie Technical High School, and (3) the Carnegie Artisan Day and Evening Classes. It is proposed that the Carnegie Technical College shall be an institution of high standing, receiving as students those who are graduates of high schools, and embracing work in pure science, in modern language, and in the following technical courses: Mechanical engineering, electrical engineering, civil engineering, chemical engineering, electro-chemical engineering, marine engineering, railroad engineering, sanitary engineering, mining engineering and metallurgy, architecture, and commerce and transportation. It is wisely proposed, also, that a large share of the energies of this college shall be devoted to engineering research, which proposal, more than any other, indicates the degree of dignity which is to be given to this branch of the work. The proposed Carnegie Technical High School is designed to combine the distinctive features of the American technical high school and the European trade school. It will receive students from the grade schools, and will afford them opportunities of both general and technical training. While the committee suggests such subjects as blast furnace and foundry practice, pattern making, metal working, gas manufacture and railroad transporta-

tion as those which should enter into the work of this school, it does not attempt to determine in what proportion the students' time shall be divided between the general and technical subjects. The evident intention, however, is to make this branch of the work most strong in those characteristics which go to make up the German trade school. It is proposed that students be allowed large liberties in the selection of their subjects. The Carnegie Artisan Day and Evening Classes are designed to open to students who are ordinarily otherwise employed, the work of the Carnegie Technical High School, thus making facilities which would otherwise only serve full time students, available for the benefit of the wage earner.

It will be seen that the expert committee, while charged with large responsibilities, has wisely refrained from any attempt to invent a new kind of education. Really nothing new or experimental is proposed, though in connection with the proposed technical high school, certain combinations of courses are proposed, which do not now exist in this country. On the other hand the proposition to consolidate all known grades of technical instruction into a single technical university is a magnificent one. The acceptance of so comprehensive a scheme by Mr. Carnegie will involve rather heavy demands even upon his extensive resources, but the expert committee cannot be charged with over-designing. Their recommendations are sound and there doubtless is a present need for every line of work which they have proposed. If, therefore, there is to be a Carnegie Technical University, it should be developed in lines not less liberal than those which have been suggested.

An International Technical Dictionary.

The Society of German Engineers has now definitely decided to go on with its project of compiling and publishing an international technical dictionary. The work will be called the Technolexikon, which is probably as short a name as could be selected. It will be published in three volumes, German-English-French, English-German-French and French-German-English. An editor-in-chief has been selected, namely, Dr. Hubert Jansen, who is now making up his permanent staff. The editorial office is established in the house of the Society, at 49 Dorotheenstrasse, Berlin, N. W.

The Society has issued a circular asking for the co-operation of societies, industrial establishments and individuals. No money is asked for, and, on the other hand, the co-operation is expected to be largely gratuitous. The Society itself bears all the expense of preparing the manuscript, but it is expected to arrange for publication finally with one or more publishers.

The societies, technical colleges, industrial establishments and individuals who may take an interest in this important work are requested to communicate with the editor, particularly suggesting the names of persons and organizations that may be useful in collaboration. It is believed that industrial establishments may be induced to help materially by selecting one or more of their staff who will be willing to contribute lists of terms, with definitions, and also by sending trade catalogues and other printed material which will help to indicate the accepted names of products and processes.

It is suggested that every collaborator shall begin by collecting technical words and expressions in his specialty, giving, so far as he may, the source of each of these. By way of systematizing this work the Society will send to those who would like to collaborate note books that have been prepared, with instructions for their use. Especial attention is called to the fact that words and expressions will be acceptable even if translations are not given.

Naturally, this comprehensive and ambitious project cannot be worked out speedily, and consequently those who may be willing to co-operate will have plenty of time. We suggest to our readers the desirability of sending to Dr. Jansen the names of institutions, firms and persons who might perhaps be induced to help in the work.

TECHNICAL.

Manufacturing and Business.

H. M. Pflager has resigned as mechanical superintendent of the Pullman Co., to become vice-president of the American Clock Company, Chicago.

The Sargent Co., Chicago, is planning to add to its plant at Chicago, Ill., a new pattern shop. This is made necessary by a largely increasing volume of business.

Universal bearings made by the Universal Car Bearing Co., Old Colony Building, Chicago, have been specified on 200 refrigerator cars ordered by Swift & Co. from the American Car & Foundry Co.

G. W. Scott, for several years mechanical engineer of the Pullman Co., has opened an office as consulting engineer at 616 Rookery Building, Chicago. Mr. Scott will conduct a general engineering practice and give special attention to the design and construction of power plants, railroad shops and factories, and the application of economical methods in existing plants and shops.

Iron and Steel.

The Bethlehem Steel Co. has given a mortgage to the Girard Trust Co., of Philadelphia, to secure $7,500,000 to acquire the plant of the Bethlehem Iron Co.

The National Steel Refining Co. was incorporated in Delaware last week, with a capital of $1,000,000, to make high grade tool steel, at a plant to be built at Carnegie, near Pittsburgh, Pa.

William Brown, heretofore Superintendent of the steel plant of the Phoenix Iron Co., Phoenixville, Pa., has resigned to accept a similar position with the Lukens Iron & Steel Co., at Coatesville. He assumed his new duties on Sept. 1.

The American Bridge Company has taken the contract for and will complete the work on the elevated tracks for the Fort Wayne entrance into the new Union Station at Pittsburgh. Work on the large trainshed at the station is to commence at once.

The Independent Steel Co. has been organized and application made for incorporation with a capital stock of $1,500,000. Contracts are said to be let for two mills. The stockholders include Cornelius J. Kane, W. O. Maloney, A. F. Baumgarten, of Pittsburgh, John R. Morehead, of New Castle, and L. L. Bergman and H. Silberman, of Cleveland, Ohio.

At the annual meeting of the Colorado Iron & Fuel Co., J. J. Mitchell, James A. Blair, John Lambert and John W. Gate were elected directors, succeeding E. Thalmann, Benj. T. Cable, J. T. Kebler and R. W. Wolcott. The following new officers were elected: Chairman, J. C. Osgood; President, J. A. Kebler; First Vice-President, A. C. Cass; Second Vice-President, Dennis Sullivan, and Third Vice-President, J. E. Heimerdinger.

Revision of M. C. B. Standard Journal Boxes.

The illustrated article having this title, on page 604, in last week's issue was written by Mr. T. H. Symington, whose name was omitted in preparing the matter for publication.

Signaling on the New York Central.

The maintenance and installation of signals on the New York Central & Hudson River Railroad has been transferred to the Engineering Department. Division Engineers will have charge and will report on these particular matters to the Engineer of Signals. They will consult with the Division Superintendents on all signal matters affecting operation. Each Division Engineer, where necessary, will be assisted by the Supervisor of Signals, who will have charge of foremen, repair men, electricians, battery men, lamp men, linemen and helpers.

Concerning That Rail Committee.

On July 19, 1901, a notice relative to the appointment of a Proposed Special Committee on Rail Sections, with ballot for voting, was mailed to each Corporate Member of the Society. [Am. Soc. C. E.] In order that it may be determined whether this committee shall be appointed or not, it is necessary that a total vote of not less than one-third of the Corporate Membership of the Society be received. Up to Aug. 14, 1901, only 522 votes on the appointment of this committee had been received. One-third of the Corporate Membership is 670; consequently, at least 148 additional votes will have to be sent in before the question can be settled. If the necessary ballot and envelope has been lost or mislaid, others may be obtained by applying to the Secretary.—August *Proceedings*.

Were we to attempt to add a word of exhortation or argument it would be only to repeat what we lately said editorially. Probably that article will not have the least influence, but if there should chance to be one member who cares to read it he may find it on page 590, Aug. 23.

THE SCRAP HEAP.

Tunnel to Brooklyn.

The New York Rapid Transit Commissioners will, on Wednesday next, make application to the Appellate Division for the appointment of three commissioners to decide whether the route selected for the extension of the underground road to Brooklyn should be approved.

Erie Railroad Coal Storage Plant.

In the annual report of the Erie, President Thomas refers to a purchase of land near Hackensack, N. J., for a coal storage plant, as follows: Shortly after the purchase by the Erie of the coal properties of the Pennsylvania Coal Co., it became necessary to establish somewhere near tidewater and within easy reach of industries consuming large quantities of coal, a storage plant for anthracite coal. Thirty-three acres of land have been bought for that purpose on the line of the New York, Susquehanna & Western, near Rochelle Park, and near its junction with the Bergen County R. R., nine miles from tidewater coal docks. Contracts have been made for a plant capable of storing 150,000 tons, with the necessary machinery to convey from the cars to storage 3,600 tons per day, and to reload from the storage piles to cars an equal amount. It is estimated that the whole plant, including grading, tracks and drainage, will cost $228,900, and that it will be finished early next winter.

LOCOMOTIVE BUILDING.

The Pennsylvania has ordered 40 freight engines from the Baldwin Locomotive Works.

The Krajewski-Pesant Co., 32 Broadway, New York City, has ordered one engine from the Baldwin Locomotive Works.

W. R. Grace & Co., 1 Hanover Square, New York City, are having eight engines built at the Cooke works of the American Locomotive Co.

CAR BUILDING.

The Atlantic Coast Line is in the market for four coaches.

The Colorado & Wyoming has ordered 300 freight cars from the American Car & Foundry Co. They will be built at Detroit.

The Vera Cruz & Pacific is having three cars for passenger service built at the Jeffersonville works of the American Car & Foundry Co.

The Cincinnati Southern will build 100 box cars in its shops at Ludlow, Ky. The special equipment includes Pressed Steel body bolsters, French springs, Winslow roofs and Jones doors. One-half the cars will have Buckeye trucks.

Swift & Co. have ordered 200 refrigerator cars of 60,000 lbs. capacity, from the American Car & Foundry Co. They will be built at Chicago. The company is said to be considering a large number of refrigerator cars in addition to the above order.

BRIDGE BUILDING.

Chagrin Falls, Ohio.—The County Commissioners will build a bridge on the Wiltshire road, five miles north of here.

Chicago, Ill.—The South Park Commissioners want bids, Sept. 11, for a granite-faced concrete and steel bridge, 180 ft. long, with a 70-ft. arch. J. F. Foster, Engineer.

Hamilton, Ohio.—Bids are wanted, Sept. 13, for two iron or steel bridges; also for abutments, masonry, etc., for several other bridges. Apply to H. C. Gray, County Auditor. (Aug. 23, p. 594.)

Kansas City, Mo.—Local reports state that the railroads and the city have reached an agreement regarding the Allen avenue viaduct. This structure, which will cost about $80,000, has long been in contemplation. Its total length will be about 1,000 ft. The portion over the Santa Fe, Memphis and Burlington tracks will be about 253 ft.

La Crosse, Wis.—According to report the Chicago, Milwaukee & St. Paul will build new drawbridges over the Black and Mississippi Rivers.

Louisville, Ohio.—The Stark County Commissioners are considering building a bridge over the tracks of the Fort Wayne Electric Ry., and the Stark Electric Ry. The cost is estimated at $25,000, the county and the railroads each to pay one-third.

Merced, Cal.—The Clerk of the Board of Supervisors has been ordered to advertise for bids for two bridges on Hopeton, Westport & Turlock road.

New York City.—The bids for the bridge over Bronx River at Westchester avenue, were opened Aug. 28. In gross they were as follows: J. G. Tait, $77,851; Snare & Triest, $84,338; Cunningham & Kearns, $88,887; United Engineering & Contracting Co., $89,981; Ryan & Parker, $92,279. The net prices vary much more widely than the totals would indicate.

Detailed working plans are being made at the Department of Bridges for the new bascule bridge to be built over Newtown Creek at Vernon avenue. It will cost about $700,000. (July 19, p. 522.)

New Westminster, B. C.—J. A. L. Waddell, of the firm of Waddell & Hedrick, engineers, Kansas City, Mo., has been put in charge of the proposed railroad and highway bridge over Fraser River, mentioned in this column Aug. 9, p. 566.

Pauling, Ohio.—The County Commissioners want bids, Sept. 12, for two bridges across the Auglaize River at Oakwood. Apply to M. P. Jacobs, County Commissioner.

Prince, Utah.—The big bridge about a mile below the town was washed away on Aug. 30.

Richmond, Va.—The Virginia Union University and other property owners propose to build a $5,000 bridge at the north end of Lombardy street, over Bacon's Quarter Branch.

San Mateo, Cal.—Bids are wanted, Oct. 1, by R. H. Jury, Clerk of the Board of Trustees, for concrete arches and girders for four bridges. The total estimate is $25,000. D. Bromfield, City Engineer.

Sherbrooke, Que.—Tenders are being received by P. J. Griffith, Secretary-Treasurer, for the superstructure of a riveted steel highway bridge of 295 ft. long. Plans, etc., at the office of John W. Burke, C. E., 45 Broadway, New York.

Smith's Landing N. J.—Bids are wanted, Sept. 11, for the substructure and superstructure of the Absecon bridge. J. J. Albertson, County Engineer.

Somerville, N. J.—Estimates for seven new bridges were presented to the Board of County Freeholders on Aug. 12 to the total amount of $34,200.

Victoria, B. C.—The Provincial Government will at once call for tenders for a bridge over the north arm of the Fraser River, within the municipality of Richmond.

The Department of Lands and Works in arranging to build another bridge over the Chimney Creek, near this place.

The City Council have been notified of the acceptance by the Dominion Government of the plans for the new Point Ellice bridge, as prepared by the City Engineer. The cost will be about $268,000.

Warren, Ohio.—The Payneville & Youngstown Ry. will build a steel bridge over Mahoney River to replace the wooden structure.

Williamsport, Pa.—The Grand Jury has recommended a bridge over Larry's Creek, at Salladasburg; a bridge over the Susquehanna between Williamstown and Du Boistown, and a bridge over Battle Run in Old Lycoming township.

Willows, Cal.—Bids are wanted by W. H. Sale, Clerk, until Sept. 17, for a steel bridge over Stony Creek at Needham Crossing.

Other Structures.

Brooklyn, N. Y.—The Brooklyn Rapid Transit Co. has broken ground for the new $100,000 car shed and depot to be built on Avenue M, between Flatbush avenue and Bergen Beach.

Chicago, Ill.—Local reports state that the Illinois Steel Co. will enlarge its plant in South Chicago to double its capacity. It was announced last December that about $1,000,000 would be spent for a structural iron department at the works.

The Logan Square terminal of the Metropolitan Elevated road was destroyed by fire on Monday morning. About a dozen cars, a train shed, repair shop, and other railroad property were burned. The loss is estimated at $100,000.

Connellsville, Pa.—Plans and specifications are reported made for a new station for the Pennsylvania in this town.

Houston, Texas.—The City Council has granted permission to the Houston & Texas Central to build a depot and rearrange their tracks leading into the city. The ordinance provides that the depot be built opposite the present union station.

Kalamazoo, Mich.—The Michigan Traction Co. has given a mortgage for $100,000 to secure funds to build car barns and repair shops. Plans will soon be ready.

NAMPA, IDAHO.—Local reports state that the Oregon Short Line will build a passenger depot at this place, at a cost of about $12,000.

NEW CASTLE, PA.—The stockholders of the Pennsylvania Engineering Works have voted to increase the capital stock $75,000, this amount to be used in making betterments to the plant, and additions to the equipment. The improvements will include a new machine shop 90 x 100 ft.

SAN ANTONIO, TEXAS.—First Vice-President Leroy Trice, of the International & Great Northern, is reported as saying that his road will build a new passenger station in San Antonio.

SAN JUAN, PORTO RICO.—The New York & Porto Rico Steamship Co. has awarded the contract for the structural steel for its new dock at San Juan, to Snare & Triest, of New York. The dock will be 460 ft. long and 80 ft. wide. Some 700 tons of steel will be required.

SEATTLE, WASH.—The Northern Pacific has building permits for a pier and warehouse at Washington street and Railroad avenue.

SHARON, PA.—The Sharon Steel Co. has let contracts for four additional basic steel open-hearth furnaces and 10 sheet mills of 100 tons daily capacity. The company has also under contemplation another 600-ton blast furnace.

ST. LOUIS, MO.—The Big Four and the Chicago & Alton will build a new freight and passenger station at Nineteenth street and the Terminal yards, according to report.

TYLER, TEXAS.—According to report, the International & Great Northern has plans ready for the proposed union depot in this city.

WILLIAMSPORT, PA.—Plans for the new station for the Pennsylvania, between Market and Pine streets, are with Division Superintendent E. B. Westfall, at Williamsport. Bids will be wanted as soon as the Council passes the ordinance closing Court street.

WORCESTER, MASS.—The Boston & Maine is having plans made for a 35-stall roundhouse at Worcester. The work will be begun as soon as possible.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xvii.)

Western Society of Engineers.

At a meeting of the Western Society of Engineers, Chicago, Sept. 4, Mr. W. H. Pratt, Superintendent of the Structural Department of the Illinois Steel Co., read a paper on "Modern Practice in Bridge Work."

American Association for the Advancement of Science.

The fiftieth annual meeting of this body opened at Denver, Aug. 26. The retiring President, Prof. R. S. Woodward, of Columbia, called the session to order and introduced the new President, Dr. C. S. Minot, of Boston. Farewell addresses were made before various sections by the retiring Vice-Presidents, including one by Mr. Brashear, on the Carnegie Technical School.

The Railroad Meeting at Glasgow.

In the Engineering Congress to be held at the Glasgow Exposition, Sept. 3 to 5, the first section is Railroads, Sir Benjamin Baker, chairman. The papers to be presented and the authors are as below: Jas. Barton, "The Proposed Tunnel Between Scotland and Ireland;" I. A. Timmis, "Modern Practice in Railroad Signaling;" Professor C. A. Carus-Wilson, M.A., "The Economy of Electricity as a Motive Power on Railroads at Present Driven by Steam;" Captain G. B. Macauley, R.E., "The Soudan Railway;" Sir Guildford L. Molesworth, K.C.I.E., "The Uganda Railway;" Professor W. C. Kernot, Melbourne, "Australian Railroads;" Horace Bell, "Cheaper Railroad Fares."

Central Railway Club.

The next regular meeting of the Central Railway Club will be held at the Hotel Iroquois, Buffalo, N. Y., on Friday, Sept. 13, 1901, at 2 p. m.

The discussion of the topical question in relation to steel driving wheel centers which was presented to the May meeting will be continued.

The special committee reports will be "Development in Car Equipment when Double-Heading with the Heavy Type of Engines." Committee—L. T. Canfield, M. C. B., D. L. & W. R. R., chairman.

"Locomotive Classification—Advisability of adopting a plan that the designating characters of figures may in themselves quite definitely indicate the type of engine." Committee—J. A. Barhydt, M. M., B. R. & P. R. R., chairman.

Memorial to the late O. O. Esser. L. H. VanAllen, D. S., L. V. R. R., chairman.

Interpretation of the Revised Rules of Interchange. Committee—J. R. Petrie, Arbitrator, chairman.

RAILROAD DAY AT THE PAN-AMERICAN.

Railroad Day at the Pan-American Exposition will be held on Saturday, Sept. 14. The President has appointed the following committee to initiate the work of arranging for a proper observance of the event: James Macbeth, chairman; O. P. Letchworth, S. H. Jones, W. H. Marshall and Pemberton Smith.

At the invitation of Mr. Macbeth, representatives of other railroad organizations in Buffalo met in conference with the Club committee, as a result of which it was agreed to assign the entire subject to an Executive Committee consisting of Mr. Macbeth, H. T. Jaeger, General Agent of the Passenger Department of the Erie Railroad; E. F. Knibloe, superintendent of the Buffalo Creek Railroad; L. A. Mattice, freight agent of the Delaware, Lackawanna & Western Railroad and L. H. VanAllen, superintendent Lehigh Valley Railroad.

The exercises will be held at 2.30 p. m. in the Temple of Music on the Exposition grounds. The chief feature will be an address by Chauncey M. Depew. Preceding Mr. Depew's address will be music, and appropriate greetings will be extended by the Hon. W. I. Buchanan, director general of the Exposition and the Hon. Conrad Diehl, Mayor of Buffalo.

PERSONAL.

(For other personal mention see Elections and Appointments.)

—Mr. George A. Nickerson, a Director of the Atchison, Topeka & Santa Fe Railway, died Sept. 2, aged 48 years.

—Mr. E. A. James, whose appointment as Superintendent of Transportation of the Canadian Pacific was recently noted, began his railroad career with this company, having entered the service when 16 years of age as an operator. In 1882 he was transferred to a similar position at Winnipeg and remained there until 1884. From 1884 to 1892 he was train despatcher, becoming Chief Train Despatcher in the Fall of 1892. This position he held for five years, at the end of which time he was appointed Division Superintendent. Mr. James assumed the duties of his present position, that of Superintendent of Transportation, in August of this year.

—Mr. Charles T. Bayless has been appointed Mechanical Engineer of the Mexican Central Railway, with headquarters at the City of Mexico, the appointment to take effect Sept. 1, 1901. Mr. Bayless is a graduate of Stevens Institute and for several years was in the engineering office of the late David L. Barnes, at Chicago. While in Chicago, Mr. Bayless was a regular correspondent of the *Railroad Gazette*. Being obliged to go South for his health, he spent about one year in New Mexico and then entered the draughting room of the Mexican Central at the City of Mexico. Here he served about four years, in that time being promoted to Chief Draughtsman. Mr. Bayless is the first to hold the office of Mechanical Engineer of the Mexican Central.

—Mr. George A. Quinlan, Vice-President and General Manager of the Houston & Texas Central, died recently. He was born at Bridgeport, Conn., Oct. 31, 1838, and entered railroad service in 1856 as a rodman. Four years later he went with the Texas & New Orleans. In October, 1860, he became Engineer and clerk to the Superintendent of Construction of the East Texas and went with the company he was with at the time of his death (Houston & Texas Central) in 1866 as Assistant Engineer on location and construction. He passed through various positions of Assistant Superintendent, Engineer and Division Superintendent, Chief Engineer and General Superintendent, until 1893, when he was appointed Vice-President and General Manager of the Houston & Texas Central.

—Mr. Olaf Hoff, Engineer of Structures of the New York Central & Hudson River, was born in Norway, April 2, 1859. He was graduated from the Polytechnic Institution of Christiania, Norway, in 1879, and came to the United States the same year. The next year (1880) he went with the Keystone Bridge Company, of Pittsburgh, as assistant foreman in the fitting shop, and later became draughtsman, Assistant to the Chief Engineer and Assistant to the Superintendent. The following year Mr. Hoff became Bridge Engineer of the Tampico Division of the Mexican Central, but the climate on the Gulf Coast being bad for his health, he became topographer, transitman, and locating engineer, also Resident Engineer in charge of construction. In 1883 he returned to the United States and went with the Shiffler Bridge Company, and in 1885 opened an office in Minneapolis as a bridge engineer and Western representative of the Shiffler Bridge Company, carrving on this business until July of the present year, when he joined the New York Central & Hudson River. He became a member of the American Society of Civil Engineers in 1885 and has designed and built numerous railroad and highway bridges, including two across the Mississippi River.

—Brigadier-General William Ludlow, U. S. A., died on Friday of last week, at Convent Station, N. J. Gen. Ludlow was a distinguished engineer and soldier, an able, courageous and high-minded gentleman, and he loved and honored the double profession which he served so well. There has long been a notion among military men in Great Britain and in the United States that an engineer officer could not be a good commander of troops, but in both countries many distinguished examples within comparatively recent years have pretty well swept away this notion, although traces of it linger. In the British army Napier, Gordon and Kitchener were engineers whose names occur to us at once, and in our own army Warren, Wright, Humphreys, Meade and Robert E. Lee were distinguished as commanders of troops and as engineers. Indeed, we have long held that the best soldier is an engineer, whether he knows it or not, for the higher problems of war are after all mostly problems of engineering. Gen. Ludlow was apparently a good example of the engineer officer, who was also a successful commander of troops, although his experience in command of troops had been but brief. He was born at Islip, L. I., Nov. 27, 1843, and graduated from West Point June 13, 1864. He was commissioned in the engineers and went to the front as Chief Engineer of the Twentieth Army Corps. He was brevetted for gallantry in action and again for distinguished service during Sherman's march to sea. After the war he did the routine work of the engineer corps, except that for three years he was at the head of the Water Department of the city of Philadelphia, on special leave of absence, and for two years he was Engineer Commissioner of the District of Columbia. In Philadelphia he made a great mark and won the respect of all honest citizens, and particularly of engineers, not only for his professional ability, but for his fearless character and his refusal to compromise with roguery. At the beginning of the war with Spain he was made Brigadier-General of Volunteers and commanded the right of the line in the advance on Santiago, and we have heard from eye-witnesses interesting accounts not only of his efficiency as a commander but of his gallantry in action. After the war he was put in command of the city of Havana. Here he did a great work in organizing the government of the city and in introducing the ideas and methods of the modern, high-class, municipal engineer. This work is perhaps most strikingly illustrated in the diagrams showing the fall in the death rate, which may be seen in the published official reports. He was made a Brigadier-General in the army and at the time of his death he was the only general officer of the line who had graduated from West Point. Indeed, there are now but three generals in the staff who are graduates of the Military Academy, viz., the Chief of Engineers, the Chief of Ordnance and the Paymaster General. After his return from Cuba he was put on the special duty of drawing up plans for an army war college and spent considerable time in Europe studying this subject. His report will doubtless be the basis for the plan of that college. Last winter he was ordered to the Philippines in command of the Southern Islands, but tuberculosis developed on the voyage out.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—It is generally understood that the Atchison System will be divided into two Grand Divisions to be known as the Eastern and Western Grand Divisions, each Division to be operated by a General Superintendent. C. F. Resseguie, now General Superintendent of the system, will be in charge of the Eastern Division and J. E. Hurley in charge of the Western Division.

Baltimore & Ohio.—The jurisdiction of the general officers of the B. & O. proper have been extended over the Ohio River, the Ripley & Mill Creek Valley and the Ravenswood, Spencer & Glenville.

Canadian Pacific Despatch.—B. D. Webber, heretofore General Agent, has been appointed General Manager, with headquarters at No. 4 Liberty Square, Boston. H. G. Leslie becomes New England Freight Agent at Boston.

Chicago, Indianapolis & Louisville.—J. Gill, heretofore Master Mechanic of the Chicago, Rock Island & Pacific, has been appointed Superintendent of Motive Power of the C., I. & L., succeeding H. Monkhouse, resigned.

Chicago, Rock Island & Pacific.—A. McCormick, heretofore Master Mechanic of the Rock Island & Peoria, has been appointed Master Mechanic of the C., R. I. & P., succeeding J. Gill, resigned.

Dalton & Alaculsy.—The officers of this company are: President, M. S. Squires; Vice-President, B. W. Foote; Secretary, D. H. Carver; Treasurer, F. W. Crandall, and General Manager, J. W. Beard. (See R. R. Construction column, April 26, p. 292.)

Denver & Rio Grande.—Theron Geddes, Auditor of the Rio Grande Western, having resigned, the jurisdiction of E. R. Murphy, Auditor of the D. & R. G., has been extended over the R. G. W. The jurisdiction of J. F. Evans, heretofore Auditor of the R. G. W., has been extended over the D. & R. G., effective Sept. 1.

Frankfort & Cincinnati.—G. B. Harper, heretofore General Superintendent, has been elected President.

Glenfield & Western.—The officers of this newly incorporated company are: President, A. S. Page; Vice-President, C. E. Campbell; Treasurer, M. S. Wilder, and Superintendent, J. M. Hines. (See R. R. Construction column, Aug. 16, p. 582.)

Intercolonial.—J. E. Muhlfeld, heretofore Master Mechanic of the Grand Trunk, has been appointed Superintendent of Machinery and Rolling Stock of the Intercolonial, succeeding G. R. Joughins, Mechanical Superintendent, resigned.

Kanawha & Michigan.—Philip Carroll has been appointed General Roadmaster.

Louisville & Nashville.—James Geddes has been appointed Assistant to the General Manager, with headquarters at Nashville, Tenn. T. E. Brooks becomes Superintendent of the Nashville Division, succeeding Mr. Geddes. The position of Assistant Superintendent has been abolished, effective Sept. 2.

Mexican Central.—Charles T. Bayless has been appointed Mechanical Engineer, with headquarters at Mexico, effective Sept. 1.

New York Central & Hudson River.—George H. Stevens has been appointed Assistant General Superintendent. William M. Kinch has been appointed Engineer of Signals. Both Mr. Stevens' and Mr. Kinch's headquarters will be at Grand Central Station, New York. P. E. Crowley, heretofore Trainmaster at Jersey Shore, Pa., has been appointed Division Superintendent, with headquarters at Corning, N. Y., succeeding J. B. Stewart, who has been assigned to special work on the Boston & Albany.

Northern Pacific.—W. L. Darling, heretofore Assistant Chief Engineer, has been appointed Chief Engineer, succeeding E. H. McHenry, resigned, effective Sept. 1.

Nova Scotian Eastern.—The officers of this company are: President, J. W. Greer, Montreal; Vice-President, J. H. Fitzgerald Fitzpatrick, New Glasgow, N. S.; Treasurer, W. C. Trotter, St. Johns, Que., and Secretary, H. H. McKay, New Glasgow. (See R. R. Construction column.)

Pennsylvania Company.—George LeBoutillier, heretofore Acting Assistant Engineer of the Southwest System at Richmond, Ind., has been transferred as Assistant Engineer of the Cleveland & Pittsburgh Division, with headquarters at Wellsville, Ohio. R. C. Harris succeeds Mr. LeBoutillier at Richmond.

Pittsburgh, Johnstown, Ebensburg & Eastern.—F. G. Patterson, Vice-President and General Manager, has resigned.

Rio Grande Western.—See Denver & Rio Grande above.

Santa Ana & Long Beach.—The officers of this company are: President, S. H. Finley; Vice-President, P. A. Stanton; Secretary, C. F. Mansur, and Treasurer, W. T. Clark. (See R. R. Construction column.)

Santa Fe Pacific.—W. G. Nevin, on Sept. 1, resumed the duties of General Manager, and A. G. Wells, who has been Acting General Manager, has been assigned to other duties.

The Pullman Company.—John Budge has been appointed Manager of the Buffalo shops, effective Sept. 1.

Toledo, St. Louis & Western.—C. F. Franklin has been appointed Superintendent of Transportation, succeeding B. R. Stephens. It is understood that Mr. Stephens will become General Purchasing Agent.

M. F. Bonzano, Chief Engineer, with headquarters at Toledo, Ohio, has resigned.

Union Pacific.—The general offices of this company and the Southern Pacific will be consolidated. The Chicago offices will be consolidated under the supervision of W. G. Neimyer, of the S. P., in charge as General Agent. J. H. Lathrop will be General Agent in St. Louis. H. W. Nathan will have charge of the Southeastern territory at Atlanta, Ga., and H. G. Kaill will have supervision over the Kansas City territory with headquarters at Kansas City, Mo.

C. Fawcett has been appointed Master Mechanic.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ARIZONA & NEW MEXICO.—This company is to build from Lordsburg, N. Mex., to Hachita, 50 miles southeast. Surveys have been completed and work is to begin Oct. 1. Contracts were let Aug. 28 to Caples, Powers & O'Conner, of El Paso, and the rails and rolling stock have been purchased. The maximum grades are $^6/_{10}$ per cent. and the maximum curves 2 deg. The corporate name of the extension is the Lordsburg & Hachita R. R. Co., and the officers are: James Colquhoun, President, and H. J. Simmons, C. Eng. & Supt. (Official.)

ATCHISON, TOPEKA & SANTA FE.—An officer writes that the extension in Indian Territory from Paul's Valley northwest to Erin Springs, 25 miles, has been located, and right of way is being secured. Contracts for grading, etc., will probably be let about Oct. 1. The maximum grades are $^6/_{10}$ of 1 per cent.; maximum curves, 2 deg. There is to be one steel bridge across the Washita River; an old structure, taken from the main line of the Gulf, Colorado & Santa Fe. No rails or rolling stock

required. It is not known whether or not new securities will be issued for the expenditure. (Aug. 9, p. 568.)

Canastota & Morrisville Electric.—A certificate of incorporation was filed at Albany, Aug. 29, with a capital stock of $200,000, for an electric railroad 15 miles long in Madison County, with Canastota and Morrisville as termini. The office of the company will be in Morrisville, and the road will run through the towns of Lenox, Lincoln, Fenner, Smithfield and Eaton. Among the directors are: Leander W. Burroughs, Morrisville; William H. Patten, Canastota, and W. Emmett Coe, Peterboro. (June 28, p. 473.)

Canadian Pacific.—Surveys are being made from Carman, Man., southwest toward Killarney, crossing the valley between Rock and Pelican Lakes, about 100 miles. Surveys are also being made from Abbotsford, which is east of Vancouver, B. C., on the Mission Branch, for 50 miles northeast to the Hope District, and it is said that the line will be completed this year as far as Chilliwack, 26 miles.

Cape Nome & Golovin Bay.—There is a project to build a road in Alaska from Cape Nome to Golovin Bay, 65 miles, with a proposed extension to Nulato, on the Yukon, 160 miles further. Another section is contemplated from Weare, 250 miles up the Yukon, to Port Valdez, 650 miles, and the company proposes to cover the intervening distance with a steamer route in summer and sledges in the winter. O. W. Button, of Kansas City, is President.

Central Indiana (Electric).—This company has been formed in Indiana, with a capital stock of $1,500,000, to build a line from Indianapolis north to Peru. This route would parallel the Lake Erie & Western, and the distance on that line is 74 miles between the points named.

Chicago Great Western.—It is said that a complete survey from some point on the line near Des Moines to a point on the Mason City & Fort Dodge near Lehigh, Iowa, will be made during the winter. The plan is to find a route north from Des Moines along the west bank of the Des Moines River to a point near Moingona, Boone County, Iowa, where the river will be crossed, and the route continued north along the east side of the river through the coal fields of Boone and Webster counties to a point on the Mason City & Fort Dodge, near Lehigh, Iowa. (Aug. 9, p. 568.)

Chicago, Milwaukee & St. Paul.—It is said that this company has surveys completed for the new line from Evarts, S. Dak., west through Wyoming and Southeastern Montana, to a point on the Yellowstone River between Miles City and Billings, and that the points for crossing the Yellowstone and Porcupine Rivers have been selected.

The contracts for the Kansas City cut-off between Davenport and Ottumwa, Iowa, have been let to Flick & Johnson, of Davenport, Iowa, and McIntosh Bros., of Milwaukee. These contracts provide for building the line from Muscatine to Rutledge, a point on the present Kansas City Division of the Milwaukee about five miles north of Ottumwa. Flick & Johnson will build the first seven miles out from Muscatine, and the west end of the line from Skunk River to Rutledge, 34½ miles in all. McIntosh Bros. will build the line from Skunk River to the end of the first seven miles out from Muscatine, a distance of 44½ miles. The total cost of building the 79 miles of road is estimated at $2,500,000. The contracts provide that the road must be completed by the last day of October, 1902. The graders will let the sub-contracts immediately and work will be under way within two weeks. (July 3, p. 491.)

Choctaw & Northern.—This company has applied to the Kansas Charter Board for permission to build a line of railroad in that State. The company has a capital stock of $4,000,000 and will build north from Geary, Blaine County, on the Choctaw, Oklahoma & Gulf, connecting with the Santa Fe in Woods or Woodward County, and run from thence to either Kiowa, Anthony or Caldwell, Kan. (Aug. 23, p. 596.)

Cumberland River & Nashville.—Work has begun on the location of this line at Monticello, Ky.

Dayton, Covington & Piqua (Electric).—Grading is nearly completed on this line in Ohio, between West Milton and Harrisburg. The total length of the line will be about 32 miles, laid with 70-lb. rails, and it is to be opened some time next spring.

Des Moines & Northern Iowa.—An officer writes that the preliminary survey has been run for 225 miles from Des Moines north and northeast to Minneapolis, by way of Boone, Webster City and Britt, Iowa, and Janesville, New Prague and Shakopee. There are 15 new stations in all on the line, the entire length of which is to be 265 miles, with maximum grades of 0.5 of 1 per cent., and maximum curves of 3 deg. The work will include one steel trestle 1,600 ft. long and 125 ft. high. (Aug. 16, p. 582.)

Edmonton & Lesser Slave Lake.—A preliminary survey is being made between Edmonton and Athabasca Landing, N. W. T., 96 miles northeast. Arthur G. Harrison, C. E., of Edmonton, is the engineer in charge.

Edmonton, Yukon & Pacific.—It is reported that the sub-grading between Edmonton and Strathcona, Alberta, four miles, is half done and the station grounds have been selected in Edmonton. This much of the line will be in operation by Nov. 1. (Construction Supplement, March 8, 1901.)

Grand Trunk.—It is said that this company is making arrangements to run over the Canadian Pacific from Toronto Junction to Wexford. Two miles of the road to connect the Grand Trunk with the Canadian Pacific at Wexford are to be built at once.

Greenwich & Johnsonville.—The contract for the grading and masonry on the seven-mile extension of this line to Schuylerville, N. Y., has been let to I. M. Luddington, of Rochester, N. Y. The Greenwich & Johnsonville is a standard gage road 15 miles long, running, at present, between the points named in New York state. The proposed extension involves seven steel bridges and a bridge across the Hudson, for which the Berlin Construction Co., of Berlin, Conn., have the contract. (June 21, p. 448.)

Halifax & South Western.—The contract for this road from Halifax to Yarmouth, N. S. (formerly known as the South Shore Ry.) has been let to Mackenzie & Mann, and work is to begin at once on the section 200 miles long between Halifax and Barrington. The 51 miles from Barrington to Yarmouth are already built. Branches are to be built from New Germany to Caledonia Corners. The Dominion Government gives a subsidy of $3,200 per mile, and the government of Nova Scotia will furnish the contractors $13,500 per mile also, at 3½ per cent. interest. By the terms of the contract, the builders are not permitted to issue any securities on the road for the purpose of raising funds, and the government takes a first mortgage on the property.

Huron, Bruce & Middlesex Electric.—Franchises have been received from the town of Goderich, Ont., on Lake Huron, for the Lake Huron end of the line. The proposed route is from Goderich to Dungannon, Lucknow, Wingham, Brussels, Seaforth and Bayfield, back again to Goderich, a total distance of about 100 miles, and for 24 miles between Lucknow and Brussels the Grand Trunk is paralleled. The first section of the line between Goderich and Dungannon is to be built at once, and the road is to be built with a view to carrying freight as well as passengers.

Mason City & Fort Dodge.—An officer writes that the grading of the extension north from Mason City to Omaha is to be done at once. Profiles and specifications can be seen at the company's office at Fort Dodge. The work on the extension, 30 miles east from Clarion, on the main line, to Hampton, Iowa, is progressing rapidly, and the company is prepared to let contracts for station buildings, stock yards, etc. Track is also being laid on the line 13 miles northwest from Mason City to Manley, Iowa, and will be completed early in September.

Mexican Continental Ry. & Steamship.—This company has been organized in Philadelphia with a capital stock of $150,000, to build a railroad across Mexico from Tampico and Tuxpan west through Queretaro, Suanqunto, Jalisco and Tepic to the Bay of Banderas, 500 miles, with branches. Henry Heil, Philadelphia, is President.

Michigan Roads.—Right of way for a steam railroad from Maybee, Mich., on the line of the Detroit & Lima Northern, has been secured to Monroe, 10 miles northwest on the Lake Shore & Michigan Southern and Michigan Central, to develop the glass sand deposit near Maybee. James Graham, of the Graham Coal & Coke Co., Detroit, is interested.

National Tehuantepec.—Traffic is said to have been resumed over the entire length of this line, from Coatzacoalcos, on the Gulf of Mexico, 175 miles southwest to Salina Cruz, on the Pacific.

Northern Pacific.—The contract for building the extension of the Green River Branch, which runs five miles north from the Kent County Lumber Company's mill in Washington, has been let to Nelson & White, of Seattle.

Nova Scotian Eastern.—This company has been formed by the consolidation of the Nova Scotia Eastern Extension Co., with the Musquodoboit. The latter was incorporated in Nova Scotia to build a line from Windsor Junction, 40 miles east along the Musquodoboit Valley to Parkers Corners, N. S., or from Dartmouth in the said valley, to Parkers Corners, with power to extend the line to Halifax. The original survey was unsatisfactory and nothing was done, but a further start has now been made. A list of the officers is given under Elections and Appointments. (June 14, p. 422.)

Ohio River & Charleston.—An extension from Huntdale, 40 miles southwest to Morganton, N. C., is proposed, and it is said that there are further intentions to continue the line to the seacoast at Wilmington, N. C.

Oregon Short Line.—Three blocks of land in Salt Lake City, a total of about 25 acres, are said to have been bought for the location of shops. The grade on the Idaho extension to Houston, Idaho, is said to be nearly completed, and track has been laid for 42 miles; as far as the first crossing of the Lost River.

Ozark & Cherokee Central.—This company has filed, in Arkansas, an amendment to its charter, which provides for an extension from Tahlequah, Ind. T., 30 miles southwest to Muscogee, crossing the Arkansas River. The line is now partly built west from Fayetteville, Ark., and the total proposed mileage from this point is 90 miles. (March 22, p. 210.)

Pennsylvania.—Rights of way are said to have been obtained for an extension of the Bridgeville & McDonald from Cecil, Washington County, its present terminus, to Venice, in the same county, four miles.

Pennsylvania Roads.—Subscriptions are being secured in York, Pa., for a railroad 15 miles long from Delta to Stewartstown, through a section of York County that has no railroad at present. The new road will feed the Northern Central.

Quebec Roads.—A local company has been formed in Quebec, with a capital of $1,500,000, to build a branch road from the site of the Quebec bridge, on the St. Lawrence River, 15 miles east of Quebec, along the coves and Diamond Harbor, and the river front from Cap Rouge to the Allan Steamship wharf. Hon. John Sharples is President.

The route is reported surveyed for the first 20 miles of the proposed government railroad to connect Old Ontario with the Temiscamingue district in the Province of Quebec.

Republic & Grand Forks.—The contract for the 35 miles in British Columbia has been let to Charles Ferguson, of Seattle, Wash. The road runs from the smelter center to the American Mining district. The contract calls for completion by Jan. 1, 1902. (June 21, p. 448.)

St. Louis & San Francisco.—An officer denies the reports that the company is interested in any way in the building of a line from Oklahoma City to Lawton, Ind. T.

Salmon River.—Fifty miles of this line, incorporated last spring in Idaho, to run from Blackfoot, on the Oregon Short Line, 100 miles northwest to Houston, are reported built. W. H. Bancroft, of the Oregon Short Line, is President. (April 19, p. 276.)

Santa Ana & Long Beach.—This is the correct name of the company mentioned Aug. 16, p. 582, as the Santa Ana & Long Branch.

Southern.—The broad-gaging of the Danville & Western is to be completed early next year, and it is said that the line is to be extended from Stuart, its present terminus, in Patrick County, Va., 110 miles west to Bristol, Va.

South Shore (Canada).—See Halifax & South Western.

Texas & Pacific.—Contracts are reported awarded for the grading and cross-ties on the extension from Newroads, La., along the Mississippi 90 miles north to Vidalia, La. The extension from Newroads has been built as far as Stonaker. (March 22, p. 210.)

Vancouver, Northern & Yukon.—Building on this line is reported begun, and it is said that the road will be finished within a year. The new government bridge across the Fraser River is to be used.

Virginia & Southwestern.—It is said that new freight yards are to be built at Bristol, Va., and land has been bought for that purpose.

Wabash.—It is said that the new connecting line, which runs from Toledo, Ohio, 54 miles west to Montpelier, will be open by Nov. 1, furnishing a direct route between Cleveland and Chicago. This branch will also furnish a connection with the Wheeling & Lake Erie.

RAILROAD NEWS.

Ann Arbor.—The annual report gives the following comparative statement of results for years ending June 30, 1900 and 1901. Gross earnings, 1900, $1,721,453; 1901, $1,754,148. General expenses, 1900, $1,324,620; 1901, $1,309,162. Net earnings, 1900, $396,833; 1901, $444,985. The percentage of general expenses to earnings was 74.63 this year, as against 76.95 last year.

Atchison, Topeka & Santa Fe.—This company is said to have purchased the Kansas Southwestern, which runs from Cale Junction to Anthony, Kan., 59 miles. The Kansas Southwestern, formerly known as the St. Louis, Kansas & Southwestern, was sold under foreclosure in 1898, and reorganized under the present name. The reorganization was incomplete, and the new securities have not been issued.

Chicago & North Western.—New articles of incorporation have been filed in Nebraska, as a preliminary to the absorption of the Sioux City & Pacific, recently purchased at auction from the Government. The capital stock is $63,000,000.

The following statement in reference to the Sioux City & Pacific has been issued by President Hughitt: "The railroad of the Sioux City & Pacific, extending from Missouri Valley to Sioux City, Iowa, from Sergeants Bluff to Moville, Iowa, and from California Junction to Fremont, Neb., heretofore leased, has been purchased by the Chicago & North Western. On and after Sept. 1 the jurisdiction of the officers of this company will be extended over the lines purchased, except that portion located between California Junction, Iowa, and Fremont, Neb., which, by lease to the Fremont, Elkhorn & Missouri Valley, will be under the jurisdiction of that company. The Fremont, Elkhorn & Missouri Valley will also have trackage privileges between California Junction and Missouri Valley, Iowa, at which latter point all transfers of traffic between the C. & N. W. and F., E. & M. V. will be effected."

Cincinnati, New Orleans & Texas Pacific.—The stockholders, on Aug. 26, approved the conditions of the proposition made by President Spencer, and agreed to by the trustees of the Cincinnati Southern, for the re-leasing of the latter for a term of 60 years, at a rental of over $1,000,000 a year. The question is still subject to approval by the trustees of the sinking fund, and then by a general vote of the people next November.

Colorado & Southern.—A semi-annual dividend of 1½ per cent. has been declared on the first preferred stock. A 2 per cent. annual dividend has been declared previously, in 1899 and 1900.

Frankfort & Cincinnati.—This road, which extends from Paris, Ky., 40 miles west to Frankfort, has been sold to New York capitalists for $350,000. The sale was in the name of Charles E. Evans, of Louisville.

Lehigh Valley.—The net earnings for the month of July from the railroad, after deducting expenses and taxes, were $306,315, as compared with $273,870 last year. For the eight months ending July 31, the earnings and income from all sources, railroad, were $17,586,442, and were $16,239,763 last year, same period. The net earnings were $3,456,786, against $2,286,898 the preceding year. The operations of the Coal Company show earnings of $1,426,309 for the same period; $1,704,215 last year; after deducting expenses and taxes, the net loss was $301,669 this year, against $557,394 last. The net earnings of both companies combined, for the same period, was $3,155,117 this year, against $1,729,503 last year.

Mexican National.—The annual report shows the gross earnings to date $4,558,865, Mexican currency. After deducting the "ordinary operating expenses," additions to equipment, etc., and depreciation, a total of $270,446, there remains net, applicable to interest on bonds, $1,505,906. In consequence of a change in the system of accounting, the usual comparison with the preceding year was not given.

Norfolk & Western.—The statement for the month of July shows passenger earnings of $237,586, a decrease of $6,369 over the same month last year. The freight earnings were $1,100,020, an increase of $60,938 over July, 1900, and the total expenses were $792,321, for 1,675 miles of road operated, a decrease of $5,313 from the expenses of operating 1,659 miles last year. After the deduction of fixed charges, etc., from net earnings the report shows a surplus of $353,124, as against $291,283 for the same period last year.

Pennsylvania.—For the seven months ending July 31 gross earnings of the Pennsylvania Railroad (directly operated) show $4,841,000 gain over 1900, and net gained $2,904,000. The Lines West gained $1,777,000 in gross and $1,317,000 in net.

Pittsburgh, Johnstown, Ebensburg & Eastern.—Traffic was resumed Sept. 3 on this line, after having been suspended for a week because of the resignation of the Manager, and a strike of the employees for their wages.

San Diego & Eastern.—It is said that $26,000 of the $50,000 needed for surveys and the purchase of rights of way for this proposed line from Yuma, Ariz., west to San Diego, Cal., have been pledged, and that surveying parties will be sent out when the sum is raised to $40,000. This road is to run between the points named near the International boundary between California and Lower California, and the distance is about 150 miles.

Toledo, Columbus, Springfield & Cincinnati (Electric).—The shareholders voted, Aug. 24, to increase the capital stock from $100,000 to $5,000,000 and authorized an issue of $2,500,000 bonds, to provide for building the projected line between the points named. (Railroad Construction, Aug. 16, p. 582.)

Union Pacific.—The report for July shows gross receipts $3,948,692, an increase of $355,589 over the same month last year. The expenses, including taxes, were $2,050,974 this year and $1,997,509 last year, giving a surplus this year of $1,897,718, against $1,595,593 last year, an increase of $302,124. The miles operated this year were 5,700; last year, 5,679.

Union Terminal (Sioux City.)—It has been announced that this company will do the Chicago & Great Western's switching and handle its freight under the same system it now uses with the Great Northern, in Sioux City. Passenger trains on the C. & G. W. are also to be run into the Union Depot, Sioux City, over its tracks.

Wabash.—It is commonly reported that this company will assume control of the Omaha & St. Louis.